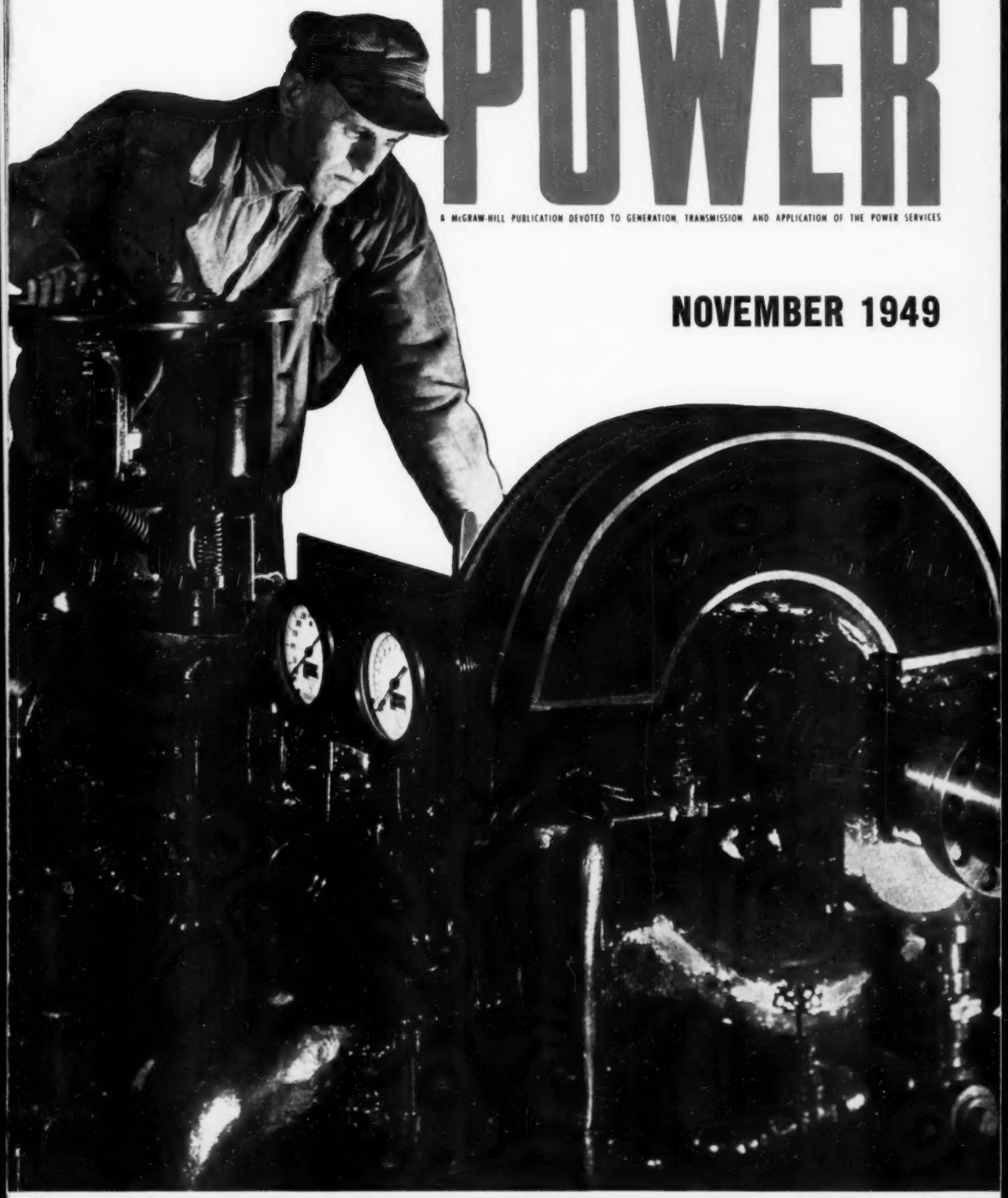
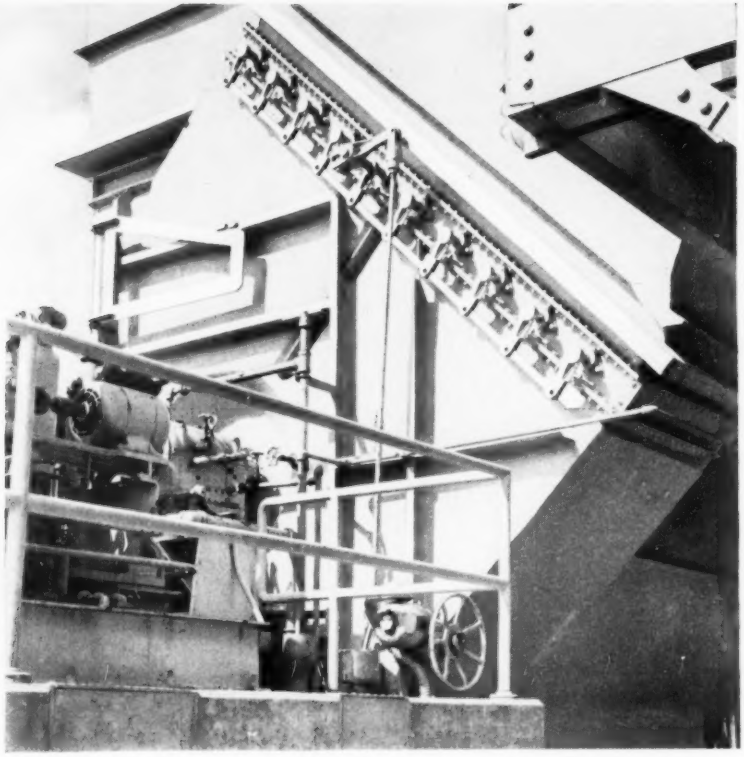
# POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

## NOVEMBER 1949



**IN THIS ISSUE:** Careful planning turns out an operator-training program that really clicks, p 74; working tools for dust collection — first of two articles on equipment for the job, p 78; waste fuels produce about 90% of pulp-mill's steam needs, p 86; water treatment for 100% make-up on a 1250-psi steam generator, p 96 **CONTENTS, p 69**



*Electric Drive Unit for Metermax Combustion Control, located completely outdoors and connected to Induced Draft Fan. Photograph Courtesy The Dayton Power & Light Company.*

# GOING "OUTDOORS"?—RELY ON ELECTRIC DRIVE UNITS!

If your organization is thinking of either semi-outdoor or complete outdoor construction for a power station, you'll find Metermax Combustion Control Drive Units ready to go right along with you—out into any weather, anywhere. Naturally you'll keep the control panels inside, but when fans are outside, their Metermax outdoor-type Electric Drive Units are completely indifferent, alike to Louisiana sun and New England snow or sleet.

What's more, the Units need no heating lines, protective hoods or other connections with "civilization" except electrical conduit—which you can bury and forget, if you wish. There are no oil lines, pistons or slides—nothing but electric motors, relays and powerful steel gears which operate in any weather with utmost dependability, protected by their weathertight, gasketed steel housings.

*Drive Unit Advantages*

Outdoors or in, Metermax Drive Units assure high-availability service. Even if de-energized by power failure, a Unit simply cannot be back-driven by its unbalanced damper or inlet vane, because the drive goes through a worm-reduction gear stage. Yet, because of this same worm, one man can operate even the heaviest de-energized Unit, by means of its handwheel. In every detail, these Units have been perfected during more than two decades of experience, to make them the ideal means of applying sensitive, accurate Metermax Combustion Control for high-efficiency operation of boiler furnaces.

For information, ask for Catalog N-01M-163. Address Leeds & Northrup Co., 4910 Stenton Ave., Philadelphia 44, Pennsylvania.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad. NU9-01-163(1)

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer" and "The Stationary Engineer"), November, 1949, Vol. 93, No. 11. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter January 26, 1949, at the post office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. Subscription rates—U. S. and U. S. Possessions $5 for one year, $7 for two years, 50c per copy. Canada $6 for one year, $9 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.

# "TWINS" for New York State Electric & Gas Corp.

## Link-Belt designed "Hickling" coal handling system duplicates "Jennison"

Above: Link-Belt belt conveyor handling No. 4 anthracite to bunker. Below: Jennison central station. Large illustration at top shows aerial view of Hickling.

Link-Belt integrated coal handling equipment scores again! The new Hickling central station of New York State Electric & Gas Corporation is a duplicate of a Link-Belt equipped station for the same utility, at Bainbridge, N. Y., (Jennison) which has been in operation for some years. Consulting engineers for both plants were Gilbert Associates, Inc.

Link-Belt equipment includes the following: Hopper with grating to receive anthracite from hopper-bottom cars . . . four reciprocating feeders discharging to No. 1 inclined belt conveyor . . . a reclaim hopper at the reserve storage pile with reciprocating feeder to effect uniform delivery to No. 1 inclined belt conveyor . . . bucket elevator for carrying coal from No. 1 belt conveyor to reserve storage or to No. 2 inclined belt conveyor which in turn discharges at 90° into an 18" screw conveyor serving two bunkers, each having a capacity of 350 tons.

We have designed and built a great many coal handling installations for both public utility and industrial power plants. Get in touch with our nearest office.

**LINK-BELT COMPANY**

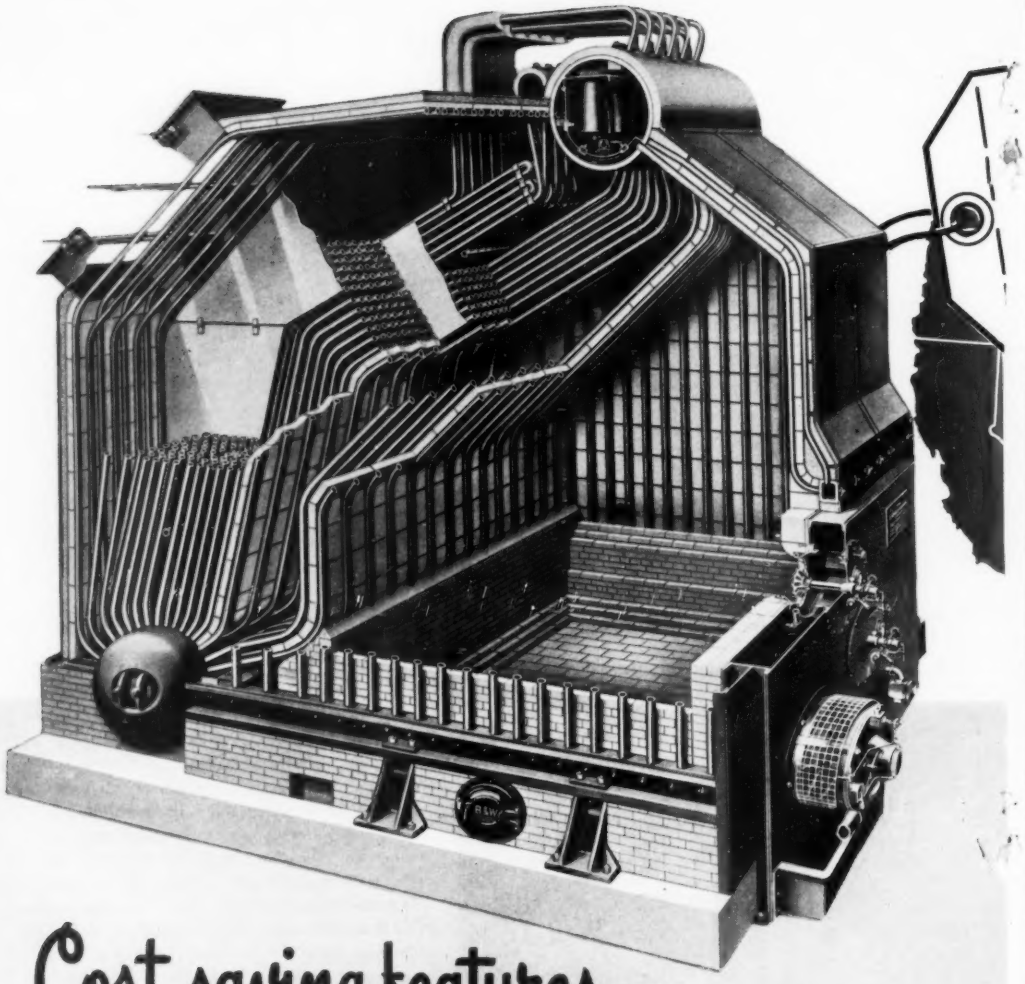
Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

11,651

**LINK-BELT**

**CONVEYING MACHINERY**

**"THE COMPLETE LINE"**

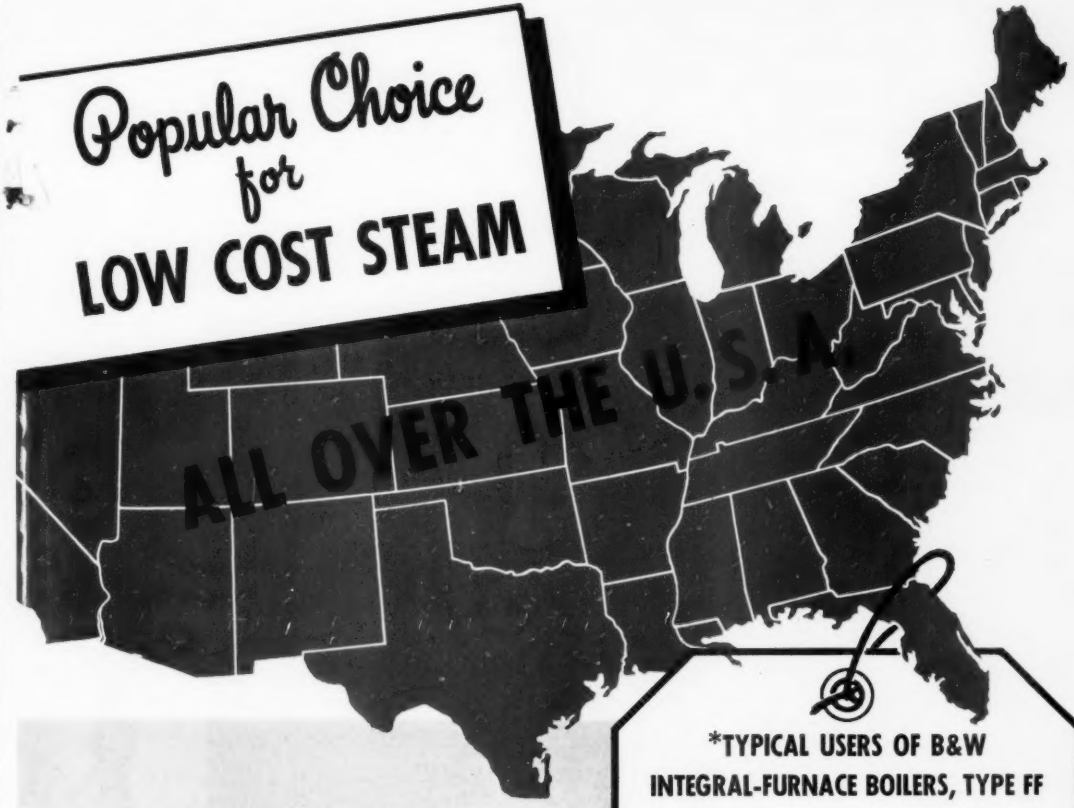


# Cost saving features

## OF B&W INTEGRAL-FURNACE BOILER, TYPE FF

- Moderate first cost
- Minimum floor space and headroom requirements
- High fuel economy
- Smokeless combustion
- Adaptable to all fuels and firing methods
- Economical fast steaming
- Water-cooled furnace
- Clean, dry steam at all ratings even with high boiler water concentrations
- Quick response to wide and heavy load swing demands
- Easy to inspect and clean
- High availability with least attention

# Popular Choice for LOW COST STEAM




It's the B&W Integral-Furnace Boiler, Type FF . . . the self-contained, compact unit that is piling up highly impressive records for economical and dependable steam generation in hundreds of widely diversified installations* all over the Nation. Operating and maintenance features listed on the opposite page indicate why this completely coordinated, standardized design has earned the confidence of industries, utilities, and other users requiring boiler capacities up to 60,000 lb. per hr. at pressures above 160 psi.

It will pay you, as it has so many others, to investigate the advantages of this outstanding B&W boiler. Begin by asking for Bulletin G-64.

BABCOCK & WILCOX

## *TYPICAL USERS OF B&W INTEGRAL-FURNACE BOILERS, TYPE FF

**INDUSTRIES**

Abrasives
Airlines
Automotive
Baking
Beverages
Brewing
Building Materials
Candy
Chemicals
Dairy
Distilling
Drugs
Electrical
Electronics
Food
Foundry
Fruit Packing
Glass
Iron & Steel
Laundry
Leather
Lumber
Machinery
Meat Packing
Metal Working
Mining
Non-Ferrous Metal
Oil Refining
Paint
Paper
Plastics
Process
Railroad
Rubber
Sugar
Textile
Tobacco

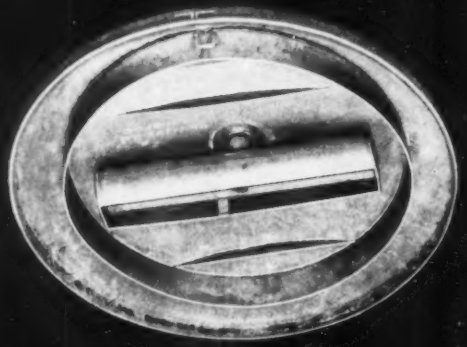
**UTILITIES**

Gas Companies
Municipal Plants
Power Plants

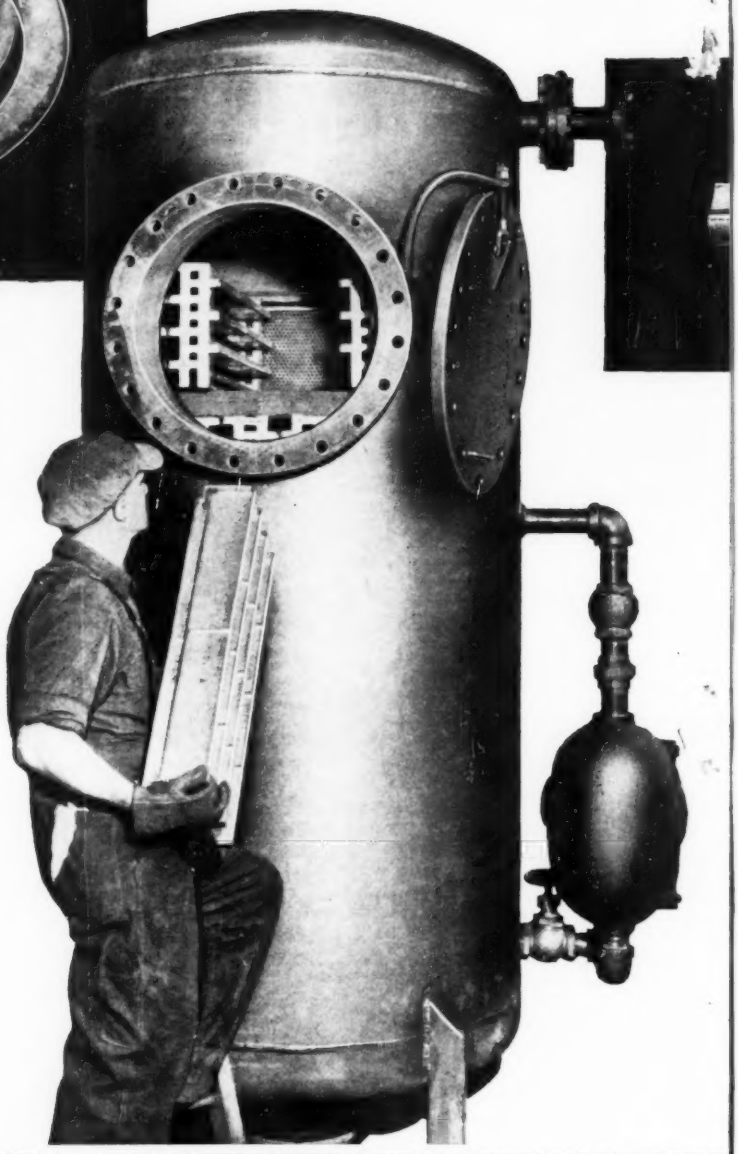
**OTHERS**

Colleges
Florists
Hospitals
Hotels
Housing Projects
Institutions
Military Posts
Navy Yards
Office Buildings
Ordnance Plants
Stores

G-467



# *This new*

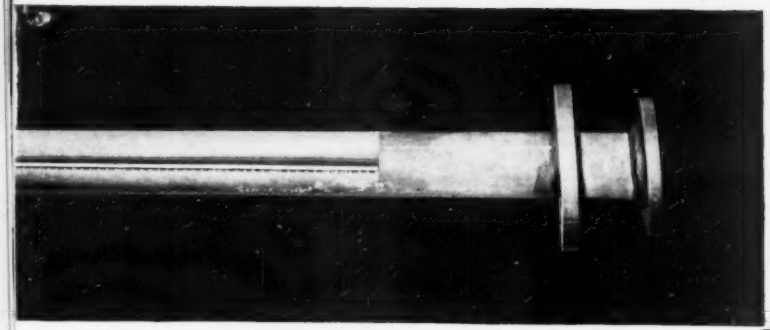


The deaerating heater head before welding in place. Showing the permanently located inner head, vent collecting hood and baffles. All this inner construction is of stainless steel.

ELLIOTT

# TRAY-TYPE

# DEAERATING HEATER
## *is completely self-contained*

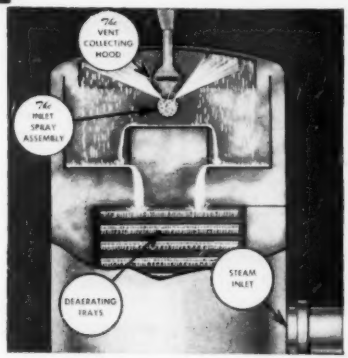


The inlet spray assembly, which with the vent collecting hood displaces the tubular vent condenser formerly used, with its many small tubes and constant maintenance problem. The inlet spray assembly can be readily pulled out if desired, although there is nothing about it to require replacement or readjustment.

**NO TUBULAR VENT CONDENSER IS NEEDED** with the new Elliott tray-type deaerating heater. This factor together with the use of stainless steel for all parts exposed to corrosive gases, eliminates practically all maintenance. However, should occasional inspection be desired, the inlet spray assembly may be readily withdrawn.

The trays too, are easy of access through the amply large inspection opening, the door of which is hung on a davit to be swung aside when the bolts are removed, and as readily replaced. Being of stainless steel the trays are comparatively light and easily handled. Trays, inlet spray assembly, and access opening cover are the only removable parts in the unit, all baffles, nozzles, etc. being permanently welded to the shell, as no maintenance or adjustment is required.

In this new deaerating heater Elliott again successfully breaks the trail toward more economical and dependable deaeration. Bulletin N-16—on request—gives the details.




Illustrating the operation of the Elliott tray-type deaerating heater. Water entering through the inlet spray assembly is sprayed across the opening of the vent collecting hood into the heating compartment, falls to the bottom of the heating section and down to the trays. By this time it has become heated to close to steam temperature. Falling from tray to tray it is constantly agitated and releases its non-condensable gases, which are carried upward by the incoming steam and ultimately through the vent collecting hood out the vent opening.

**ELLIOTT COMPANY Deaerator & Heater Dept.**
**JEANNETTE, PA.**
PLANTS AT: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
*DISTRICT OFFICES IN PRINCIPAL CITIES*

N-996

DEAERATING HEATER

# 84.8%

# 1949 Listing of Typical Central-Station

For notes on uses and limitations of this tabulation • See page 96

*Compiled by B G A Skrotzki, Associate Editor*

| Company | Location | Plant Name | Consulting Engineers |
|---|---|---|---|
| Public Service Co of Indiana | Edwardsport, Ind | Edwardsport | Sargent & Lundy |
| Savannah Electric & Power Co | Savannah, Ga | Riverside | Stone & Webster |
| Tampa Electric Co | Tampa, Fla | Hookers Point | Stone & Webster |
| Central Illinois Electric & Gas Co | Rockford, Ill | Sabrooke | Stone & Webster |
| Western Massachusetts Elec Co | West Springfield, Mass | West Springfield | Stone & Webster |
| Virginia Electric Power Co | nr Dumfries, Va | Possum Point | Stone & Webster |
| West Penn Power Co | Milesburg, Pa | Milesburg | Sanderson & Porter |
| The United Illuminating Co | New Haven, Conn | English | Westcott & Mapes |
| Indianapolis Power & Light Co | Martinsville, Ind | White River | Gibbs & Hill |
| South Carolina Power Co | Charleston, S C | Hagood | Gilbert Associates |
| Philadelphia Electric Co | W Norriton Town, Pa | Barbadoes | |
| Duquesne Light Co | South Heights, Pa | Frank R Phillips | |
| West Texas Utilities Co. | Quahnah, Texas | Lake Pauline | Sargent & Lundy |
| | Amherst, Texas | Plant "X" | |
| Southwestern Public Service Co. | Amarillo, Texas | Plant[N] | |
| | Roswell, N. M. | Roswell | Stearns-Roger Mfg Co. |
| | Abernathy, Texas | Turn[N] | Stearns-Roger Mfg Co. |
| | Springfield, Ohio | Mad River | Commonw & Southern |
| Ohio Edison Co | Toronto, Ohio | Toronto | Commonw & Southern |
| | Akron, Ohio | Gorge | Commonw & Southern |
| Oklahoma Gas & Electric Co | W. of Okla. City, Okla. | Mustang | Pioneer Serv & Engrg. |
| | Minneapolis, Minn | Riverside | Pioneer Serv & Engrg. |
| | Sioux Falls, S. D | J L Lawrence | Pioneer Serv & Engrg. |
| Northern States Power Co | Mankato, Minn | G H Wilmarth | Pioneer Serv & Engrg. |
| | Springfield, Minn | Whitney | Pioneer Serv & Engrg. |
| | St. Cloud, Minn | French Island | Pioneer Serv & Engrg. |
| | La Crosse, Wis | Grand Forks | Pioneer Serv & Engrg. |
| | Grand Forks, N. D. | Grand Forks | Pioneer Serv & Engrg. |
| Madison Gas & Electric Co | Madison, Wis | Blount | Mead & Hunt |
| **600 PSIG TO 799 PSIG** | | | |
| Pennsylvania Electric Co | Indiana County, Pa | Seward | Gilbert Associates |
| Holyoke Water Power Co | Holyoke, Mass | No. 1 | Jackson & Moreland |
| Interstate Power Co | Sherburn, Minn | Fox Lake | Sargent & Lundy |
| Central Louisiana Electric Co | St. Landry, La | Coughlin | Sargent & Lundy |
| Fitchburg Gas & Elec Light Co | Fitchburg, Mass | Sawyer Passway | Chas T Main, Inc |
| Texas Electric Service Co | Wichita Falls, Texas | Wichita Falls | Ebasco Services, Inc. |
| Dallas Power & Light Co | Dallas, Texas | Mountain Creek | Ebasco Services, Inc. |
| Imperial Irrigation District | El Centro, Calif | El Centro | Gilbert Associates |
| Minnkota Power Cooperative, Inc | Grand Forks, N. D. | Grand Forks | Ellerbe & Co |
| Public Service Co of New Mexico | Albuquerque, N. M | Prager | Stearns-Roger Mfg Co. |
| The Tucson Gas, Elec Lt & Pwr Co | Tucson, Arizona | No. 3 | Sanderson & Porter |
| Grand River Dam Authority | Pryor, Oklahoma | Chouteau | W R Holway & Assoc |
| New Hampshire Gas & Electric Co | Portsmouth, N. H | Portsmouth | Gilbert Associates, Inc |
| **UNDER 600 PSIG** | | | |
| Omaha Public Power District | Omaha, Neb | South Omaha | |
| Central Ohio Light & Power Co | Bluffton, Ohio | Woodcock | Sargent & Lundy |
| Iowa-Illinois Gas & Electric Co | Coralville, Iowa | Coralville | United Lt & Rwy Serv |
| Public Service Co of New Mexico | Santa Fe, N. M | Santa Fe | Stearns-Roger Mfg Co. |
| Georgia Power & Light Co | Waycross, Ga | Gibbs & Hill | Gibbs & Hill |
| Missouri Public Service Corp | Sedalia, Mo | Sedalia | Burns & McDonnell |
| Public Service Co of Colorado | Grand Junction, Colo | Grand Junction | |
| Wellsboro Electric Co | Wellsboro, Pa | Wellsboro | Stone & Webster |
| | Beulah, N. D | Beulah | Zack C Hinds |
| Montana-Dakota Utilities Co | Bismarck, N. D | Bismarck | Stearns-Roger Mfg Co. |
| | Kinsnud, N. D | Kinsnud | C M Garland & Co. |
| Public Service Co of Oklahoma | Lawton, Okla | Lawton | Stearns-Roger Mfg Co. |
| New York Steam Corp | New York, N Y | 66th Street | Baker & Spencer Inc. |
| The Connecticut Power Co | Stamford, Conn | Stamford | Stone & Webster |
| Hope Natural Gas Co | Hastings, W. Va | Hastings | Dravo Corp. |
| **MUNICIPAL PLANTS** | | | |
| Board of Public Utilities | Kansas City, Kan | | Burns & McDonnell |
| Electric Department | Austin, Texas | | Burns & McDonnell |
| City of Springfield | Springfield, Ill | Lakeside | Burns & McDonnell |
| City of Cleveland | Cleveland, Ohio | Lakeside | Burns & McDonnell |
| City Electric Dept | Rochester, Minn | Silver Lake | Sargent & Lundy |
| Eugene Water & Electric Board | Eugene, Oregon | Steam | |
| City of Ames | Ames, Iowa | | Burns & McDonnell |
| City of Henderson | Henderson, Ky | | Burns & McDonnell |
| Municipal Electric Light Plant | Hagerstown, Md | | Albert C Wood |
| Columbia City | Columbia, Ind | Light | |
| Municipal Power & Light | Trinidad, Colo | | Rocky Mountain Co. |
| City of Coleman | Coleman, Texas | | Terrell Bartlett Engr. |
| Municipal Power & Light | Pella, Iowa | | Brown Engrg Co. |
| Municipal Utilities | Owensboro, Ky | | Black & Veatch |
| City of Alliance | Alliance, Neb | | Black & Veatch |
| Valley City | Valley City, N. D | | |
| Board of Public Works | Hannibal, Mo | Hannibal | Black & Veatch |
| Salt Riv Valley Water Users Assn | Tempe, Ariz | Crose Cut | C C Moore & Co |
| Municipal Public Utilities | Owatonna, Minn | | Pfeifer & Shultz |
| Department of Utilities | Schuyler, Nebr | | Black & Veatch |
| City Utilities | Fort Wayne, Ind | Lawton Park | |
| Municipal Utilities | Marshall, Mo | | Black & Veatch |
| Municipal Utilities | Madison, Minn | | Perkin & McWayne |
| Borough of Etna | Etna, Pa | | Joseph Breslove |
| Municipal Light Plant | Quakertown, Pa | | Gilbert Associates, Inc |
| City of Hamilton | Hamilton, Ohio | | Emery, Markeet, Emer |
| Municipal Power & Water | Metropolis, Ill | | Rogers Schmidt |
| Water & Light Dept. | Clarksdale, Miss | | Black & Veatch |
| Public Utilities Commission | Redwood Falls, Minn | | G M Orr Engrg Co. |
| Light & Water Utility | Richland Center, Wis | | Ralph D Thomas |
| Municipal Water & Light | Hope, Ark | | F W Rabe |
| City of McLeansboro | McLeansboro, Ill | | S J Sibley & Assoc |

# 1949 Listing of Typica

For notes on uses and limitations of this tabulation • See page 96

*Compiled by B G A Skrotzki, Associate Editor*

| Company | Location | Plant Name | Consulting Engineers | First Operation, Year Units |
|---|---|---|---|---|
| **1500 PSIG AND ABOVE** | | | | |
| Indiana & Michigan Elec Co | Lawrenceburg, Ind | Tanners Creek | Amer Gas & Elec Serv | 12-50 |
| Appalachian Electric Pwr Co | Graham Sta, W. Va | Philip Sporn | Amer Gas & Elec Serv | 7-51 |
| | | | | 10-51 |
| Commonwealth Edison Co | Stickney, Ill | Edgeland | Sargent & Lundy | 9-50 |
| | | | | 9-51 |
| Central Hudson Gas & El Corp | Dannkammer Pt, N. Y. | | Burns & Roe, Inc | 1-52 |
| Consolidated Edison Co of N. Y | Brooklyn, N. Y | Hudson Ave | | 9-51 |
| **1000 TO 1499 PSIG** | | | | |
| Pennsylvania Power Co | West Pittsburgh, Pa | New Castle | Commonw & Southern | 10-51 |
| Boston Edison Co | Weymouth, Mass | Edgar | Jackson & Moreland | 8-49 |
| Rochester Gas & Electric Corp | Rochester, N Y | Russell | Gilbert Associates, Inc | 10-51 |
| Con Gas Elec Lt & Pwr Co, Balt | Turner, Md | Riverside | | 10-51 |
| Dayton Power & Light Co | nr Miamisburg, Ohio | O H Hutchings | Ebasco Services, Inc | 1950 |
| Central New York Power Corp | Oswego, N Y | Oswego | | 1951 |
| N Y. State Elec & Gas Corp | Johnson City, N. Y | Goudey | Gilbert Associates | 1951 |
| Potomac Electric Power Co | Washington, D C | Benning | | |
| Wisconsin Electric Power Co | Port Washington | | | 1951 |
| Pacific Gas & Electric Co | Bakersfield, Calif | Kern | Stone & Webster | |
| | Moss Landing, Calif | Moss Landing | Stone & Webster | |
| | Antioch, Calif | Contra Costa | Bechtel Corp | 1952 |
| Florida Power Corp | Booth Point, Fla | Higgins | The Kuljian Corp | 2-51 |
| | St. Petersburg, Fla | Bayboro | The Kuljian Corp | 12-49 |
| The Detroit Edison Co | Detroit, Mich | Connors Creek | | 4-51 |
| Cambridge Electric Light Co | Cambridge, Mass | Kendall St | Gilbert Associates, Inc | 12-50 |
| Kansas City Power & Light Co | Kansas City, Mo | Northeast | | 11-49 |
| | | Hawthorn | Ebasco Services, Inc | 1950 |
| New Jersey Power & Light Co | Holland, N J | Gilbert | Gilbert Associates, Inc | 10- |
| Illinois Power Co | nr Alton, Ill | Wood River | Sargent & Lundy | 12-49 |
| | | | | 12-50 |
| Union Electric Co of Missouri | St. Louis County, Mo | Meramec | | 1952 |
| Duke Power Co | Pelzer, S C | Lee | | 12-50 |
| Pennsylvania Power & Light Co | nr Sunbury, Pa | Sunbury | Ebasco Services, Inc | 5-51 |
| Carolina Power & Light Co | Lumberton, N C | Lumberton | Ebasco Services, Inc | 9-49 |
| Louisana Power & Light Co | nr Westwego, La | Ninemile Point | Ebasco Services, Inc | 4-51 |
| Montauk Electric Co | Somerset, Mass | Somerset | Stone & Webster | 9-51 |
| Virginia Electric & Power Co | Bremo Bluff, Va | Bremo | Stone & Webster | 1950 |
| Delaware Power & Light Co | Wilmington, Del | Edge Moor | United Engr & Const | 1951 |
| Georgia Power Co | Yates, Ga | Yates | Commonw & Southern | 1950 |
| Alabama Power Co | Gorgas, Ala | Gorgas | Commonw & Southern | 1951 |
| Utah Power & Light Co | Salt Lake City, Utah | Salt Lake City | Bechtel Corp | 1951 |
| Philadelphia Electric Co | Philadelphia, Pa | Richmond | | 1950 |
| Dallas Power & Light Co | Dallas, Texas | Parkdale | Ebasco Services, Inc | 5-52 |
| Omaha Public Power District | Omaha, Nebr | Jones Street | | 7-49 |
| Northern Indiana Public Serv Co | Michigan City, Ind | Michigan City | Sargent & Lundy | 10-50 |
| Cincinnati Gas & Electric Co | Cincinnati, Ohio | Miami Fort | Sargent & Lundy | 11-49 |
| | Jackson, Miss | Rex Brown | Ebasco Services, Inc | 12-49 |
| Mississippi Power & Light Co | | | | 12-49 |
| | Natchez, Miss | Natchez | Ebasco Services, Inc | 2-51 |
| **900 PSIG TO 999 PSIG** | | | | |
| Illinois Power Co | nr Havana, Ill | Havana | Sargent & Lundy | 12-48 |
| | | | | 4-50 |
| | | | | 6-50 |
| El Paso Electric Co | El Paso, Texas | Rio Grande | Stone & Webster | 3-51 |
| The Cleveland Elec Illum Co | Cleveland, Ohio | Lake Shore-A | | 11-50 |
| | Avon Lake, Ohio | Avon | | 8-49 |
| Wisconsin Public Service Corp | Green Bay, Wis | Pulliam | Pioneer Serv & Engrg | 9-49 |
| | | | | 1951 |
| Florida Power & Light Co | Sarasota, Fla | Sarasota | Ebasco Services, Inc | 12-50 |
| Gulf Power Co | Pensacola, Fla | Pensacola | Commonw & Southern | 8-49 |
| | Albany, Ga | Mitchell | Commonw & Southern | 11-48 |
| | | | | 3-49 |
| Georgia Power Co | Atlanta, Ga | Atkinson | Commonw & Southern | 11-48 |
| | Arkwright, Ga | Arkwright | Commonw & Southern | 11-48 |
| Texas Electric Service Co | Fort Worth, Texas | Handley | Ebasco Services, Inc | 10-50 |
| | Colorado City, Texas | Morgan Creek | Ebasco Services, Inc | 4-50 |
| | | Mountain Creek | Ebasco Services, Inc | 5-49 |
| Dallas Power & Light Co | Dallas, Texas | | | |
| | | Dallas | Ebasco Services, Inc | 1-51 |
| | | Gable Street | Ebasco Services, Inc | 3-50 |
| Houston Lighting & Power Co | Houston, Texas | West Junction | Ebasco Services, Inc | 6-50 |
| | | | | 2-51 |
| | | | | 1948 |
| Central Arizona Light & Power Co | Phoenix, Arizona | Phoenix | Ebasco Services, Inc | 1949 |
| | | | | 1950 |
| Texas Power & Light Co | Trinidad, Texas | Trinidad | Ebasco Services, Inc | 11-49 |
| Kentucky Utilities Co | Pineville, Ky | B U Park | Sargent & Lundy | 7-51 |
| Southwestern Gas & Elec Co | Mooringsport, La | Lieberman | Sargent & Lundy | 4-49 |
| | Easton, Texas | Knox Lee | Sargent & Lundy | 12-50 |
| Central Power & Light Co | Laredo, Texas | Laredo | Sargent & Lundy | 5-51 |

*A* —Air cooled
*AAlBr* —Arsenical aluminum-brass
*AAd* —Arsenical admiralty
*AlB* —Aluminum-bronze
*AlBr* —Aluminum-brass
*AC* —Allis-Chalmers Mfg Co
*C* —Coal, bituminous
*CE* —Combustion Engineering-Superheater, Inc
*Cu* —Copper
*CP* —Controllable-pitch blower
*Cr* —Curtiss-Wright Corp
*G* —Natural gas
*GE* —General Electric Co
*H* —Hydrogen cooled
*Hyd* —Hydraulic coupling
*K* —E. Keeler Co
*L* —Lummus

# of these installations having Soot Blowers have

# DIAMOND Soot Blowers

## and Municipal Power-Plant Installations

## Central-Station and I

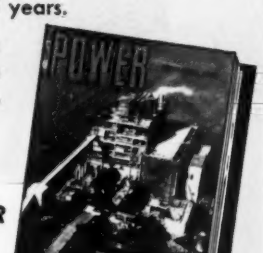
**In the 10 previous Surveys published by Power since June, 1934, the average for DIAMOND SOOT BLOWERS was**

**83.6%**

Year-after-year-after-year this overwhelming preference for Diamond Soot Blowers continues among the most critical buyers. The reason? It must be that the superiority of Diamond Blowers is almost universally recognized . . . superiority of performance that results from correct application engineering, better design and the unique Diamond service policy.

When this advertisement was prepared, soot blowers had been purchased for all plants on the list shown here that will use them, with the exception of only three (which will not significantly affect the result). Note also that the Diamond percentage for this most recent survey maintains the high Diamond average of the 10 similar surveys made by Power during the past 15 years.

**The conclusion is obvious: Diamond Soot Blowers mean cleaner boilers at lower cost.**

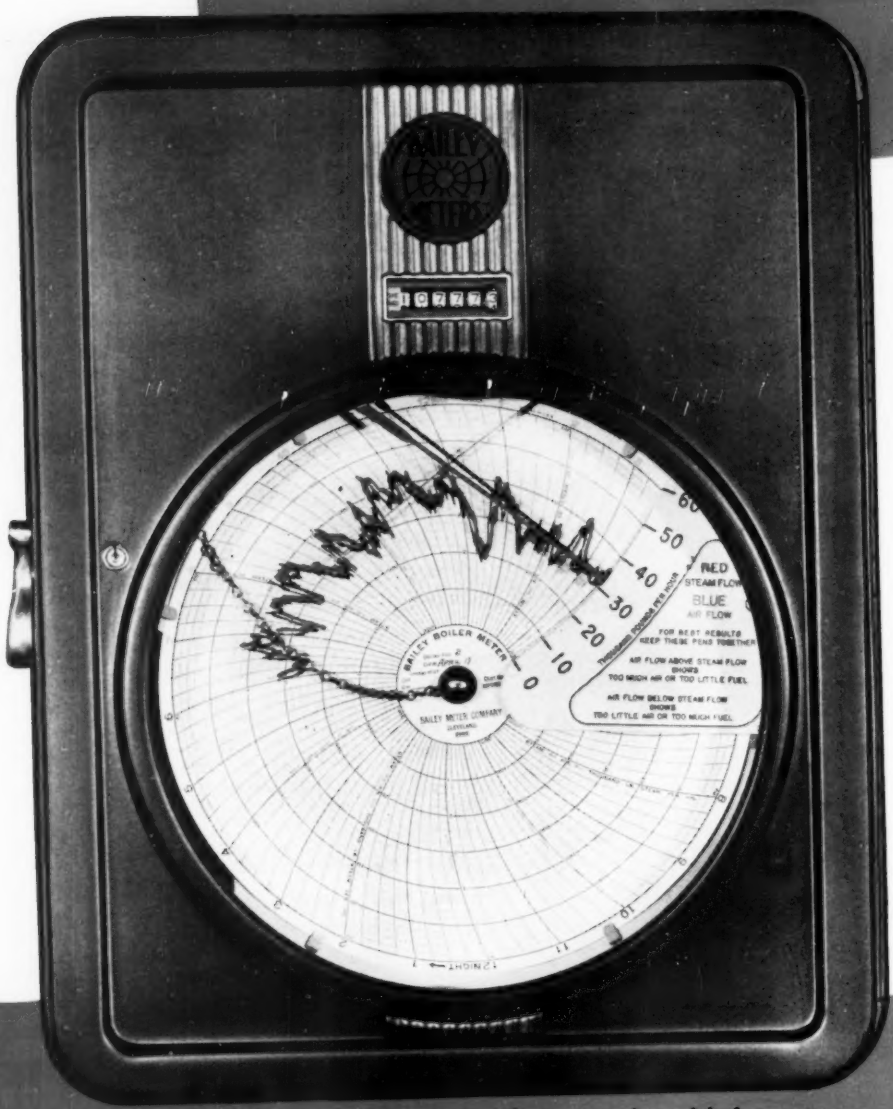



***List Published in POWER September, 1949***

4051

**DIAMOND POWER SPECIALTY CORP.**
DETROIT 31, MICHIGAN
*Diamond Specialty Limited, Windsor, Ontario*

# Whatever Fuel




*Bailey Controllers of this type accurately measure and record the factors upon which controls are based.*

# You Burn—You'll Save Money with BAILEY CONTROLS

**You'll get high Economy, Safety and Availability because Bailey Controls, working from the accurate measurements of Bailey Meters, do the right thing at the right time.**

### Bailey Combustion Control

1. Secures instant response to changes in load by regulating both fuel and air at the same time.
2. Maintains optimum fuel-air ratio as measured by Bailey Meters.
3. Gives you the same complete control, when you change fuel, or even when you burn waste.

### Bailey Three-element Feed Water Control

1. Reacts quickly and yet retains high stability by accurately measuring Steam Output and Feed Water Input and by controlling the rate of feed water input so that it equals steam output.
2. Surge resulting from severe load changes is held to a minimum by the action of flow ratio and level components which may be adjusted to conform with boiler characteristics and operating conditions.
3. Needs no excess pressure control because its operation is based in part on an accurate measurement of feed water input.
4. Power used by feed pumps may be reduced by applying Three-element Feed Water Control directly to pump speed.

### Bailey Steam Temperature Control

Maintains uniform temperature by controlling primarily from boiler load and by readjusting from temperature.

### Bailey Feed Heater Control

1. Gives smooth efficient flow through heaters because its multi-element action incorporates accurate measurements of both flow and level.
2. Permits the use of smaller storage capacity heaters and tanks thereby reducing the cost of initial equipment.

### Bailey Pump By-Pass Control

Protects pumps by opening a by-pass valve when flow through the pump drops below the safe minimum value.

**BAILEY METER COMPANY**

1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

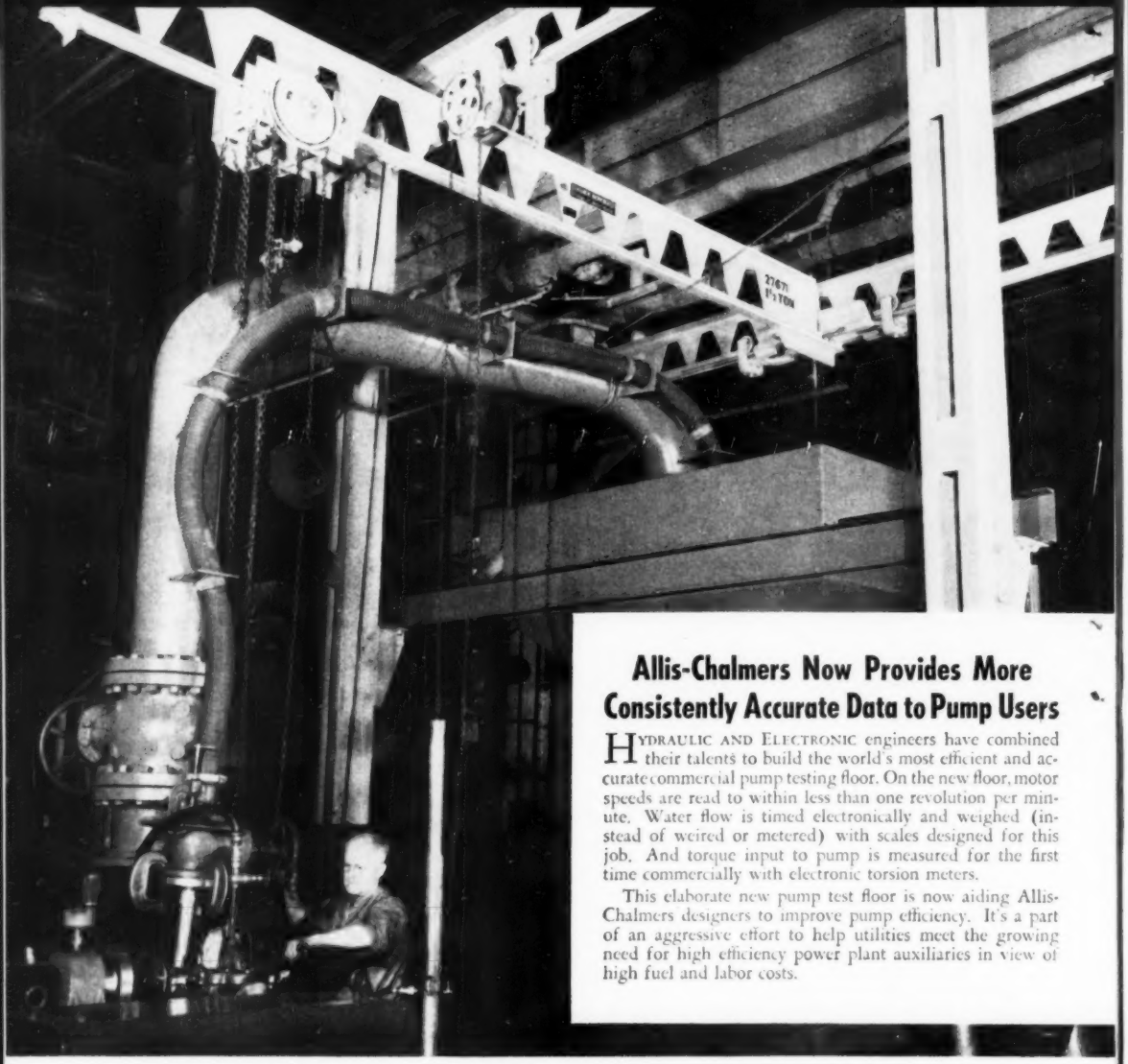
*Controls for Steam Plants*

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

A-99

## Allis-Chalmers Builds for Electric Utility Progress . .

# Worlds Finest



### Allis-Chalmers Now Provides More Consistently Accurate Data to Pump Users

HYDRAULIC AND ELECTRONIC engineers have combined their talents to build the world's most efficient and accurate commercial pump testing floor. On the new floor, motor speeds are read to within less than one revolution per minute. Water flow is timed electronically and weighed (instead of weired or metered) with scales designed for this job. And torque input to pump is measured for the first time commercially with electronic torsion meters.

This elaborate new pump test floor is now aiding Allis-Chalmers designers to improve pump efficiency. It's a part of an aggressive effort to help utilities meet the growing need for high efficiency power plant auxiliaries in view of high fuel and labor costs.

Water is pumped into tanks at right where it is weighed to provide more accurate check than weiring or metering.

**1933** — 5/8% Step Regulator was introduced by A-C. Set new standards for voltage regulation. Over 5,000,000 kva now regulated by A-C 5/8% step units.

**1949** — New Pole Type 5/8% Step Regulator introduced by A-C. Makes possible close, automatic city type voltage regulation in rural areas for first time.

**ALLIS-**

*Pioneers in Power*

# Pump Test Floor

In addition, the new test floor removes the human element from routine testing of production pumps . . . provides more consistently accurate data than was heretofore possible.

For years Allis-Chalmers has maintained files of complete performance data on every pump it builds. The new test floor now assures Allis-Chalmers pump buyers of a completely mechanical check of performance unequalled anywhere.

All of this is done in the interest of providing better facilities . . . better products . . . better service for the Electric Power industry.

Take advantage of the benefits of these new facilities. Investigate the pumps A-C builds for the power plant. They range from small general purpose and ash slurry pumps up to the largest circulating and boiler feed designs. Call in an A-C engineer to talk over your pumping problems with you.

A-2851

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

Accurate recording instruments in new control room remove human element from test procedures.

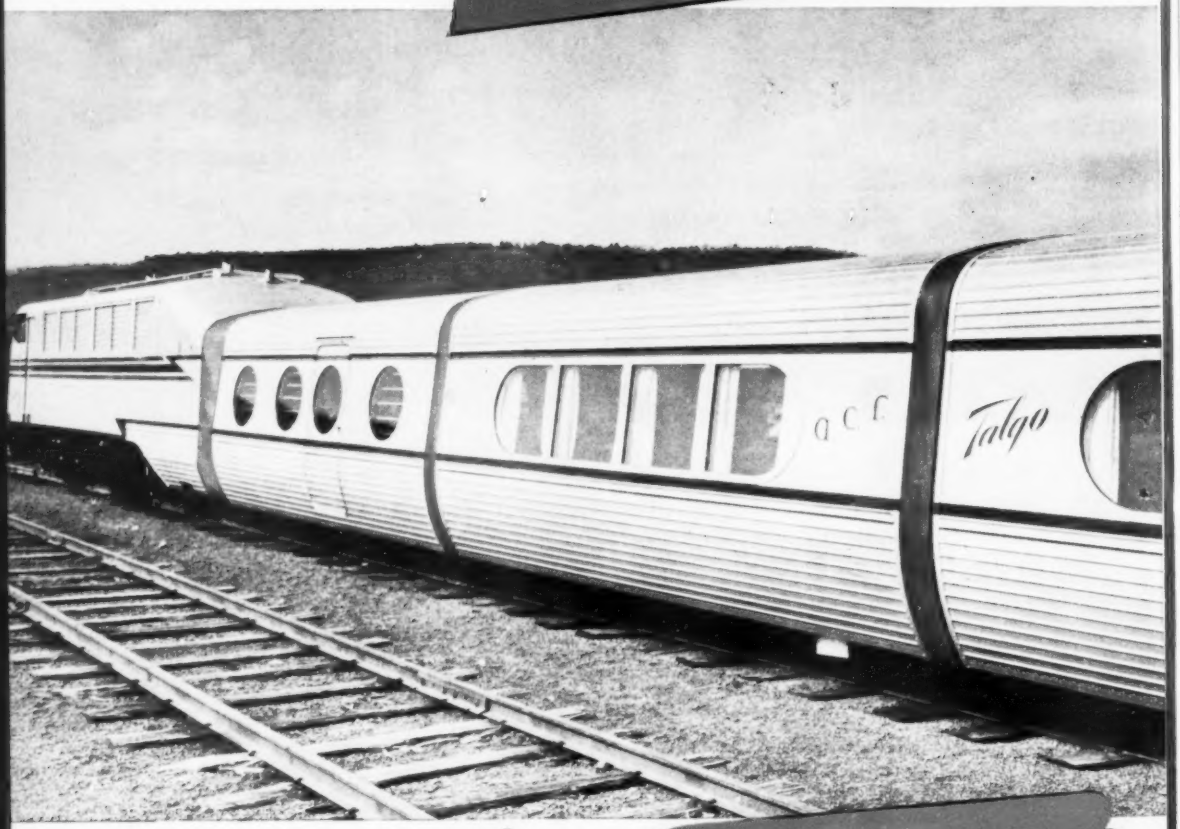
# CHALMERS

A-C ALLIS-CHALMERS

*and Electrical Equipment from Generation through Utilization*

# Air of

BELOW, the ACF-Talgo Train,
A Bold Step in
Railroad Progress.




"Buffalo"

"FIRST FOR FANS"

# PROGRESS

PROGRESS: "The action of advancing or improving by marked stages or degrees" — Webster

## ★ "Buffalo" FANS COOL MOTORS ON ACF *Talgo* TRAIN

Extremely light and low — embodying revolutionary design throughout, such as individual wheel suspension — this new train promises much to the industry. Its Diesel Electric locomotive is entirely new, too — low, compact and exceptionally fast.

American Car and Foundry engineers chose "Buffalo" blowers to provide cooling air to the traction motors.

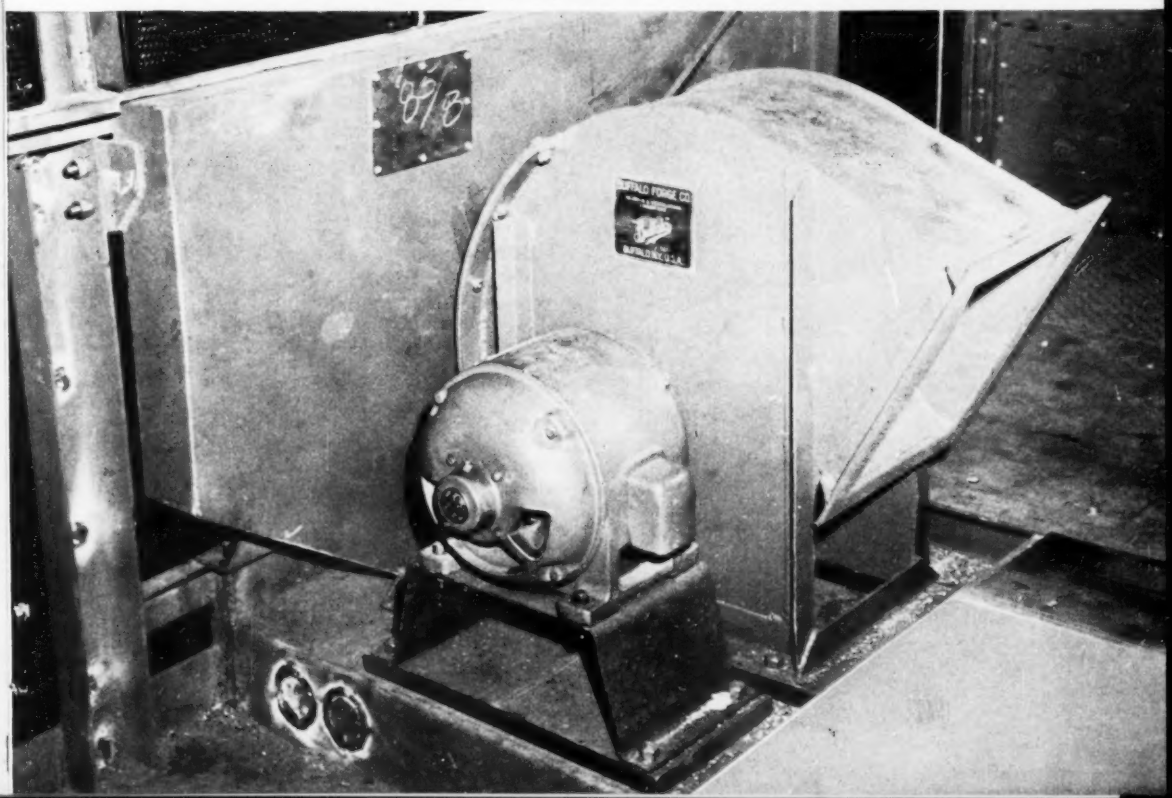
The engineering reasons for selecting these blowers were their small outside dimensions and light weight for the capacity required.

Whatever need you have for air — ventilation, mechanical draft, blowing, exhausting, conveying, drying or comfort conditioning — look to "Buffalo". Because the "Buffalo" line is so complete, and because "Buffalo" has supplied Industry with quality air-handling products for 71 years, you can be sure of the exact results you want. Engineering bulletins on the full "Buffalo" line available to you on request. . . . Simply write:

**BUFFALO FORGE COMPANY**

488 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Branch Offices in all Principal Cities



# Here's a Tip
## FOR SELECTING

"Renewo" Globe Valve Regular Type, "P" Type or "PS" Type

## LUNKENHEIMER "RENEWO" VALVE *Threesome*

**1. REGULAR TYPE** *"Renewo"* Nickel Alloy Seat and Disc for general service.

**2. "P" (PLUGTYPE)** *"Renewo"* "NS5" Nickel Alloy 330 Brinell Seat and Disc for throttling, drain, drip, water column blow-down and like service.

**3. "PS" (PLUG TYPE)** *"Renewo"* Stainless Steel 500 Brinell Seat and Disc for close throttling and other severe erosive service.

***THREE WAY INTERCHANGEABILITY REDUCES MAINTENANCE EXPENSE***

# THE *RIGHT VALVE* ...FOR THE *RIGHT PLACE!*

If you just want an extra good valve for general service, then choose the "Renewo" with Regular Type Nickel Alloy Seat and Disc. It's tops in its class.

Or, perhaps you have a throttling condition such as drain, drip, water column blow-down and like service where regular seats and discs tend to cut out... use the "P" (Plug Type) "Renewo" with 330 Brinell "NS 5" Alloy Seat and Disc. Here you have high resistance to wear and corrosion.

And for severe close throttling and erosive service, particularly where abrasive conditions are present... the "PS" (Plug Type) "Renewo" with 500 Brinell Stainless Steel Seat and Disc will solve the problem.

ESTABLISHED 1862

**THE LUNKENHEIMER CO.**

"QUALITY"

**CINCINNATI 14, OHIO, U.S.A.**

NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34

EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

*... and look at these money saving extra features!*

**1.** Each type of seat and disc is interchangeable one with another, making it possible to convert a regular type valve into a plug type without taking the valve out of the line.

**2.** Available in 200 lb. S.P. as well as 300 lb. S.P. making it unnecessary to purchase a 300 lb. valve for 200 lb. service.

**LUNKENHEIMER VALVES**

PRIMER FOR PROFIT

# When is a steam plant old?

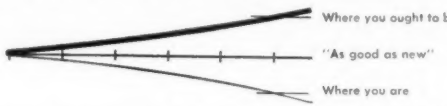
Calendar years alone do not tell the complete story of a steam generating unit's age. For instance, if you have a 25-year old unit, and disregard normal deterioration, you could chart the years like this:

but in that time its effectiveness has probably fallen off like this:

Now, rehabilitation *could* restore it to what is commonly regarded as "As good as new condition" by general overhaul and replacement of all worn out parts:

But in the years since you originally installed the equipment, technical advances in design have improved overall performance of new units like this:

So "as good as new" isn't good enough. It won't bring your unit up to the performance possible with a modern unit. Your situation may actually look like this:




The upper curve above shows the performance possible with a new unit. But only modernization can bring you to that point.

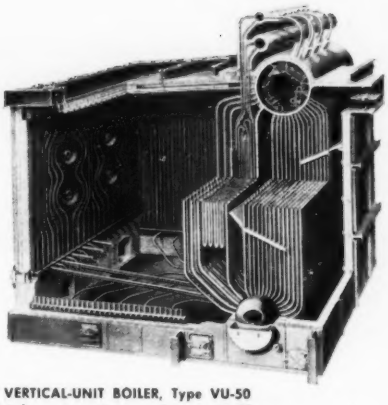
The improved overall performance of modern steam generating and fuel burning equipment—plus the increased cost of both fuel and labor—have actually accelerated the rate of obsolescence of your equipment . . . have hastened the day when replacement will pay handsome dividends.

The chances are that steam plant modernization will cut *your* overall production costs . . . will help *you* solve today's most difficult problem—the diminishing margin between selling price and operating costs.

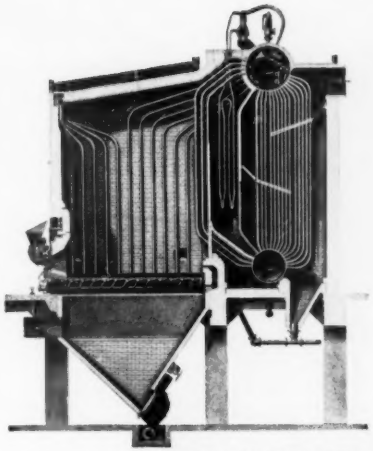
Modern boiler equipment, like that shown on the opposite page, is the answer to the problem of bringing your steam plant performance up to the best modern standard. Combustion's years of experience are yours for the asking—no obligation, of course. B-346

**COMBUSTION ENGINEERING**

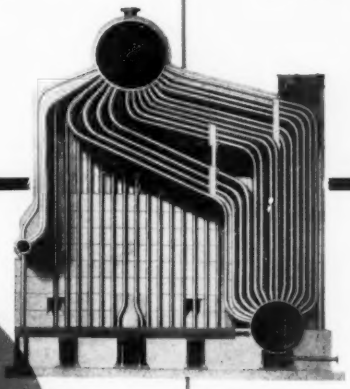
A MERGER OF COMBUSTION ENGINEERING COMPANY, INC. AND THE SUPERHEATER COMPANY



**C-E VERTICAL-UNIT BOILER, Type VU-50**
*For higher capacity requirements. Designed for firing by pulverized coal, oil or gas alone or in any combination.*



**C-E VERTICAL-UNIT BOILER, Type VU-30**
*For medium capacity requirements. Adapted to the use of any type of mechanical stoker or oil or gas.*



**C-E VERTICAL-UNIT BOILER, Type VU-10**
*For smaller plants and those having limited operating personnel. May be fired by C-E Underfeed, Spreader or Traveling Grate Stokers or oil or gas.*

# C-E VERTICAL UNIT BOILERS

If the story on the opposite page applies to your plant—if the combination of normal and accelerated obsolescence has brought your equipment to where it will be less expensive (in the long run) to replace it than to keep it—then the C-E Vertical-Unit Boiler line may well offer the right answer to your situation. For here is a group of carefully engineered and standardized units that represent the best modern standards in steam generating equipment.

The three boilers illustrated—and others in the line not shown—are collectively designed to serve virtually every industrial requirement from about 10,000 to 300,000 (or more) lb of steam per hour, pressures up to 1,000 psi and steam temperatures to 900 F. The entire Vertical-Unit line offers the advantages of time-tested standards of design coupled with that flexibility of application—fuels, firing methods, operating conditions, etc.—required to meet particular plant needs. We shall be pleased to supply catalogs and any additional information required upon request.

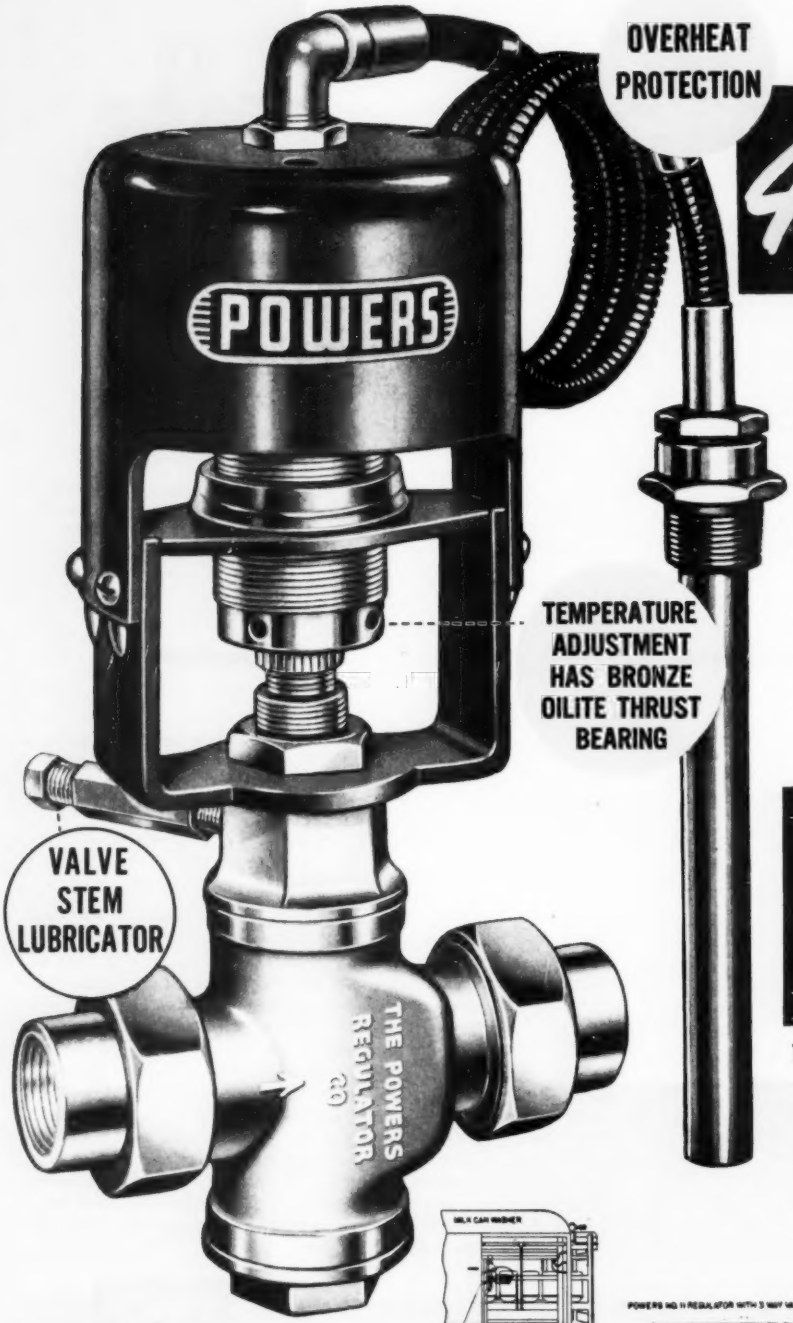
## —SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

# OVERHEAT PROTECTION

# 4 PLUS...




**VALVE STEM LUBRICATOR**

**TEMPERATURE ADJUSTMENT HAS BRONZE OILITE THRUST BEARING**

**SIZES: ¼" to 6" inclusive**
**60° F. Ranges**

## CONTROLS TEMPERATURE OF LIQUIDS OR AIR

### TYPES AVAILABLE:

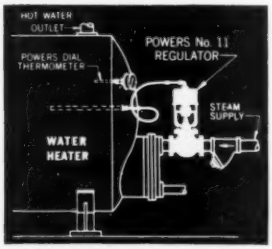
Direct and reverse acting regulators—

**Double Seat Balanced Valve**
Double unions ½" to 2" inclusive, flanged 2½" to 6" inclusive.

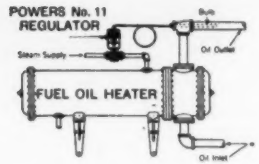
**Single Seat Valve**
Double unions ¼" to 1½" inclusive.

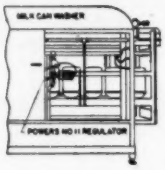
**3-Way Water Mixing Valve**
½" to 4" inclusive.

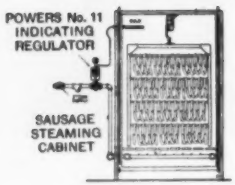
**Temperature Indicating Regulator**
*All are shown in Bulletin 329. Get a copy and prices from our nearest office.*

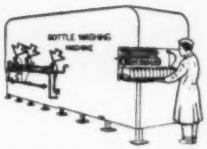


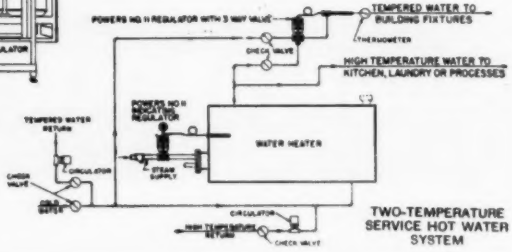

## TYPICAL APPLICATIONS




TWO-TEMPERATURE SERVICE HOT WATER SYSTEM

# SIMPLE ★ DEPENDABLE ★ ECONOMICAL

# VALUES IN POWERS No. 11 self-acting TEMPERATURE REGULATOR

## No. 11 INDICATING REGULATOR

Thermometer has a 4" dial and is mounted on top of the regulator. Both thermometer and regulator operate from same thermal system. Only one tapped opening required. A visual check on performance of the regulator is provided and it is easy to adjust for different temperatures.

## Gives BETTER Control

*. . . extra years of service*

Bigger value than ever before is available in this modern POWERS regulator. Use it wherever you want a simple dependable control to maintain a constant temperature.

- IT PREVENTS OVERHEATING
- SAVES FUEL AND LABOR
- HELPS INSURE A UNIFORM PRODUCT
- MANY GIVE 10 TO 25 YEARS OF SERVICE
- OFTEN PAYS BACK ITS COST SEVERAL TIMES A YEAR

For valuable help in selecting the proper type and size for your requirements contact our nearest office. Consult your phone book or write to—

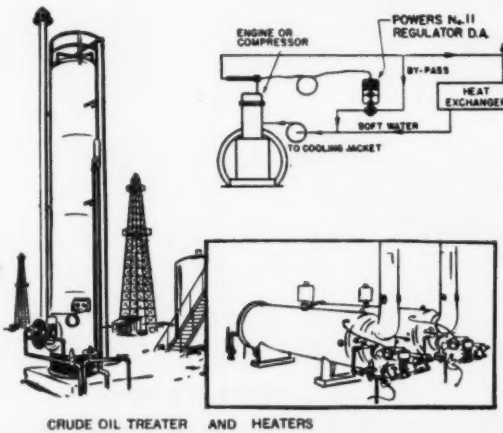
**THE POWERS REGULATOR CO.**

CHICAGO 14, ILL., 2720 Greenview Avenue • NEW YORK 17, N. Y., 231 East 46th Street
LOS ANGELES 5, CALIF., 1808 West Eighth Street • TORONTO, ONT., 195 Spadina Avenue

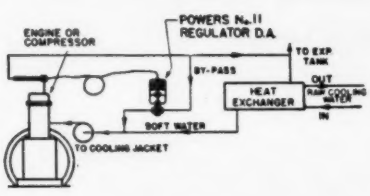
*58 Years of Temperature and Humidity Control*

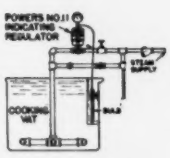
OFFICES IN 50 CITIES • SEE YOUR PHONE BOOK

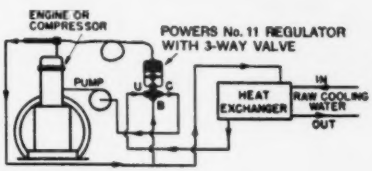
POWERS

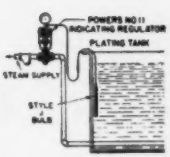


CRUDE OIL TREATER AND HEATERS





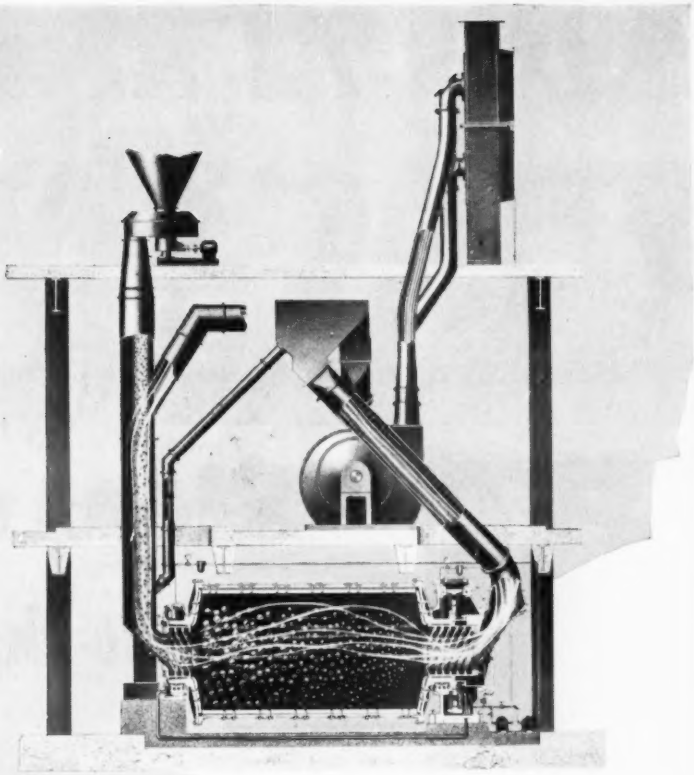



# MAXIMUM FLEXIBILITY IN COAL SELECTION with KVS AIR SWEPT TUBE MILLS

Any coal . . . bituminous or anthracite . . . in any quantity, can be prepared as superfine fuel, ready for delivery to the combustion chamber.

This ability to pulverize any coal and convert it to what in effect is a highly combustible gas, means that no limitations are imposed in selecting the coal which will assure the maximum in fuel value and the minimum in steam costs.

All other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels for high operating efficiency and a maximum of economy at all boiler ratings.



*Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.*

KENNEDY-VAN SAUN
Kennedy Products
NEW YORK USA
MFG. & ENG. CORP.
QUALITY SERVICE

**Kennedy-Van Saun**

MANUFACTURING AND ENGINEERING CORPORATION

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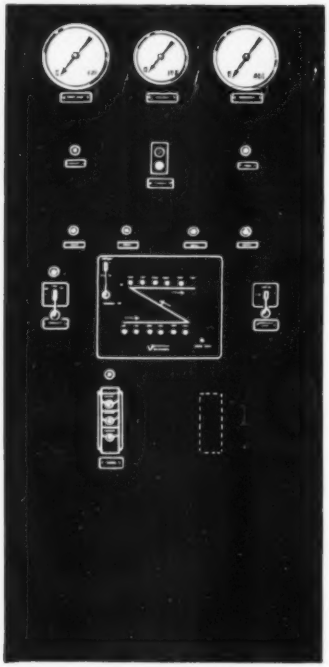
# ANOTHER VULCAN 1ST

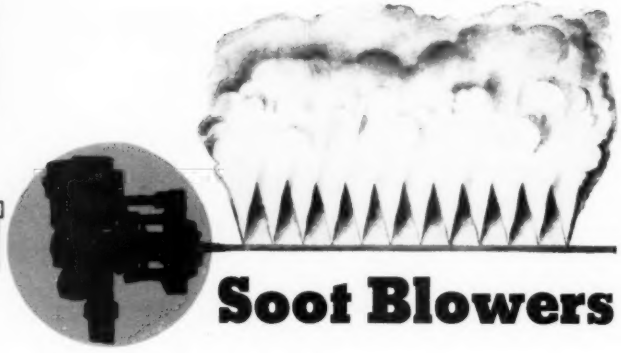
**The Vulcan Automatic Sequential Soot Blowing**



## Blow with

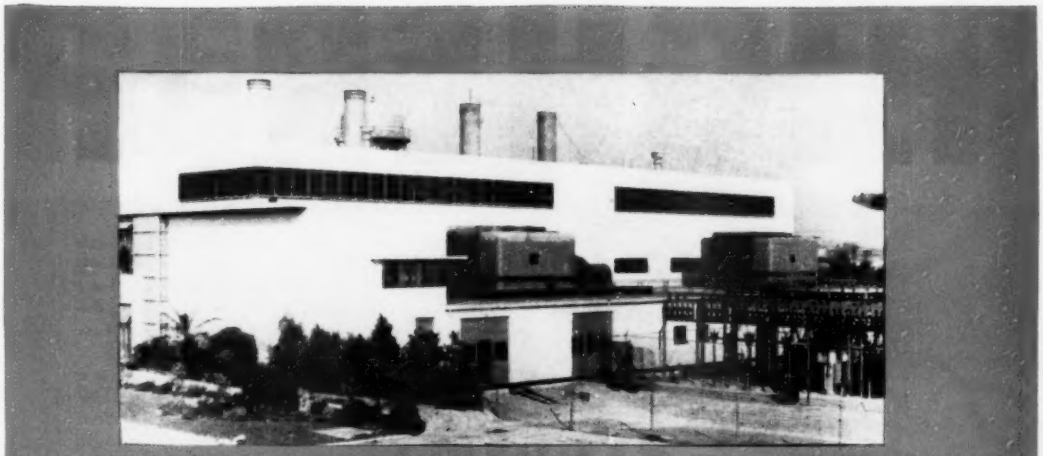
## No change in

Panel for the Vulcan Automatic Sequential Soot Blowing System for City of Burbank's new C-E boiler rated at 225,000 pounds per hour. 875 psi. 910 F.



**VULCAN**
**STEAM OR AIR**

**Soot Blowers**



System at the City of Burbank, California, will

# AIR—or with STEAM

## equipment . . . Simply operate 2 valves

SIMPLY close one valve and open another—and this unique Vulcan soot blowing system uses either compressed air or steam as the cleaning medium. This dual-media system assures:

BETTER CLEANING: You have high-pressure steam instantly ready if needed to combat severe slagging, or if air supply fails. You have 100 percent soot blower availability.

LOWER COST: You need but one air compressor, saving about 40 percent of the cost of the standard air installation.

**VULCAN SOOT BLOWER CORPORATION**
**DUBOIS, PENNSYLVANIA**
Division of CONTINENTAL FOUNDRY & MACHINE COMPANY

## —Serve Better ● at Lower Cost

# HIGHER P

*Call For*

## YARWAY UNIT TANDEMS

Years of service in the high pressure plants of leading Utilities and Industrials have proved the soundness of design and metallurgy of Yarway Unit Tandems.

Yarway Unit Tandems are built for pressures up to 2500 psi. Combining a Stellite-Seat and a Seatless valve in a single one-piece forged steel body, this tandem provides the advantages of both designs—for blowing and for sealing—in a compact, rugged unit.

Inside (next to boiler) blowing valve is the Yarway Stellite-Seat valve.

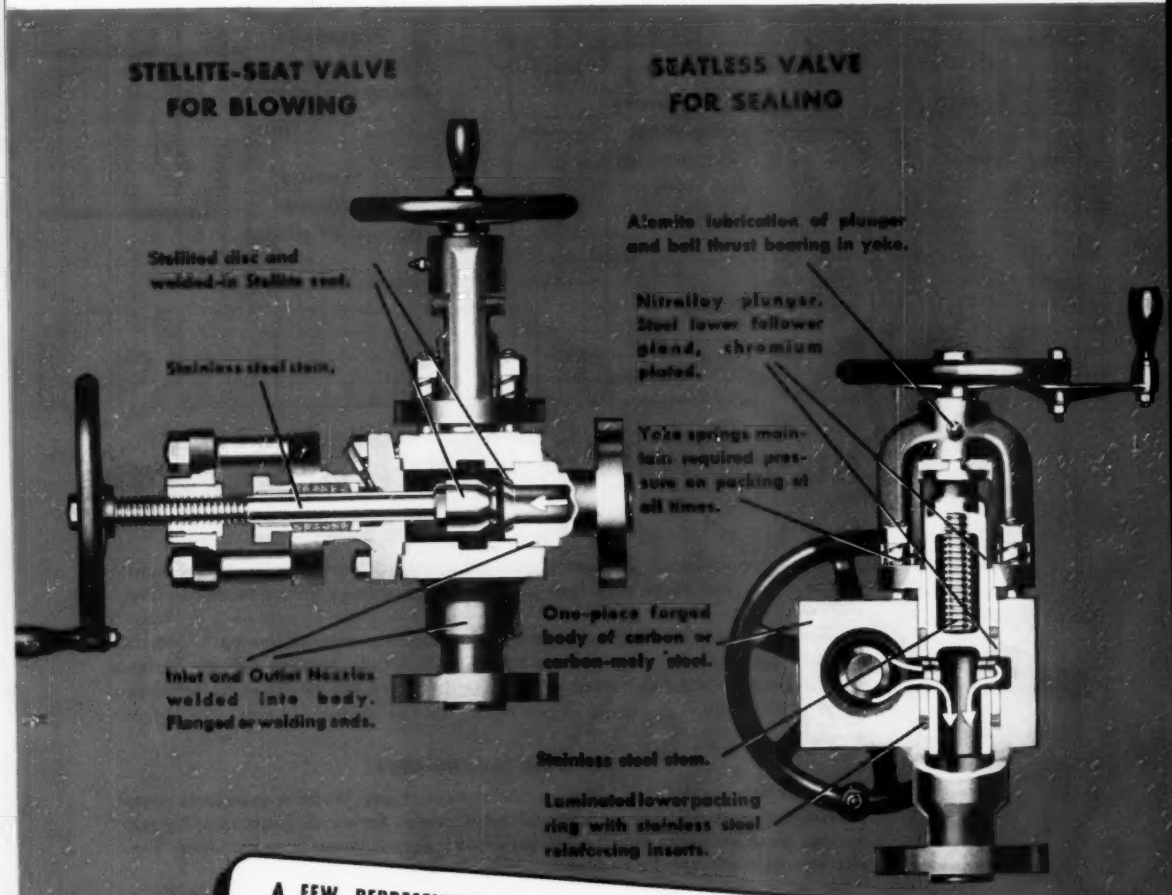
Outside sealing valve is the famous Yarway Seatless design which has no seat to score, wear and leak. This valve is opened first and closed last, maintaining a tight seal at all times.

Write for Bulletin No. B-432.

**YARNALL-WARING COMPANY**
700 Mermaid Avenue
Philadelphia 18, Penna.

YARWAY

# RESSURES


STELLITE-SEAT VALVE
FOR BLOWING
SEATLESS VALVE
FOR SEALING
Stellited disc and welded-in Stellite seat.
Stainless steel stem.
Inlet and Outlet Nozzles welded into body. Flanged or welding ends.
Alemite lubrication of plunger and ball thrust bearing in yoke.
Nitralloy plunger. Steel lower follower gland, chromium plated.
Yoke springs maintain required pressure on packing at all times.
One-piece forged body of carbon or carbon-moly steel.
Stainless steel stem.
Laminated lower packing ring with stainless steel reinforcing inserts.

**A FEW REPRESENTATIVE USERS OF HIGH PRESSURE YARWAY BLOW-OFF VALVES**

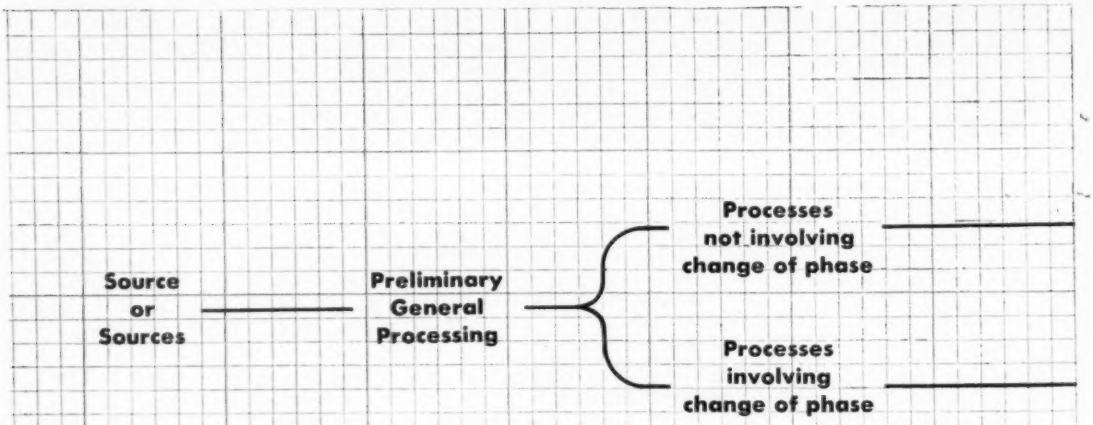
**• UTILITIES •**

Philadelphia Electric Co.
Boston Edison Co.
Pacific Gas & Electric Co.
Pennsylvania Power & Light Co
Georgia Power Co.
Cleveland Elec. Illuminating Co.
Connecticut Light & Power Co.
Indiana-Michigan Power Co.

**• INDUSTRIAL PLANTS •**

Celanese Corp.
R. J. Reynolds Tobacco Co.
Eastman Kodak Co.
Armour & Co.
American Viscose Co.
Lever Bros. Co.
Armstrong Cork Co.
Bethlehem Steel Co.

# BLOW-OFF VALVES


Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

# Water Problems neither *begin*

In the modern industrial plant, water presents serious problems, not only in the boiler but at every point in its path from source, through power plant or factory to final disposal.

The accompanying diagram gives a rough approximation of this path, but no diagram can show the almost infinite variations in detail. Nor can a diagram even suggest the problems which arise at every point, and the intricate cross-relationships between problems.

## SOME TYPICAL PROBLEMS

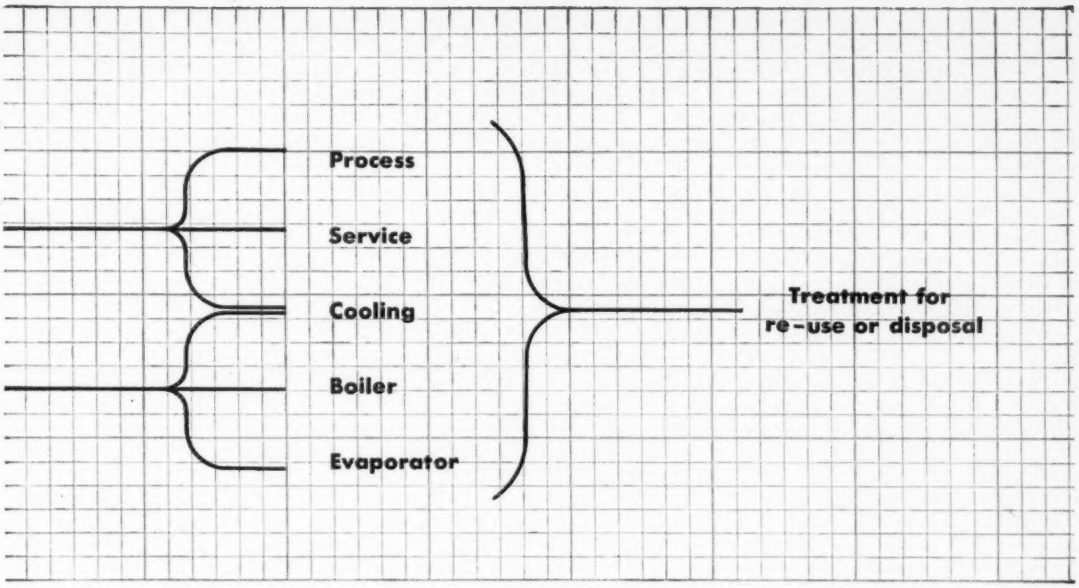
These problems begin when planning of the plant begins. Water requirements must be analyzed in detail. The amounts of water needed for steam generation, for the various plant processes and for general factory service must be determined. The characteristics of water for each use must be specified.

Water sources must be studied. How much water can be made available? From what sources? What are the characteristics of the available waters? Is there possible contamination from other plants? Should separate water systems be set up or should water from all sources be combined? Are algae or chemical-forming bacteria present in harmful amounts?

Is any preliminary treatment of the entire supply required? What types of treatment?

These are just a few of the questions that arise, and their answers are interwoven with other problems. Characteristics of the water will determine methods of treat-

HAGAN
HALL
BUROMIN
CALGON




# nor *end* at the boiler

ment; amounts of water available will influence the selection of a cooling system; supply, characteristics, and contamination during use will be factors in determining methods of purification for re-use or disposal.

Economic considerations are always present. Solutions of a sort may be relatively easy. The major problem is to devise appropriate inter-related procedures which, giving due weight to investment, operating expense and maintenance cost, establish the most efficient and economic balance for the specific situation.

## SCOPE OF HALL SERVICE

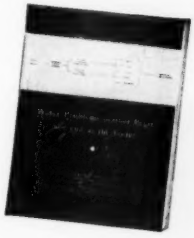
*Every one of these problems comes within the scope of Hall Laboratories.* More than twenty years ago, Hall entered this field by introducing the Hall system of boiler water conditioning. This system—maintenance in the boiler of certain essential chemical equilibria—is now standard practice.

During its existence, Hall Laboratories has steadily expanded its activities. It has serviced thousands of plants, and has continued fundamental research not only in boiler water conditioning but in all phases of industrial water conditioning.

Hall Laboratories is at your service in connection with any problem pertaining to the use of water in industrial plants.

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania

**May we send you a copy of this Bulletin?**

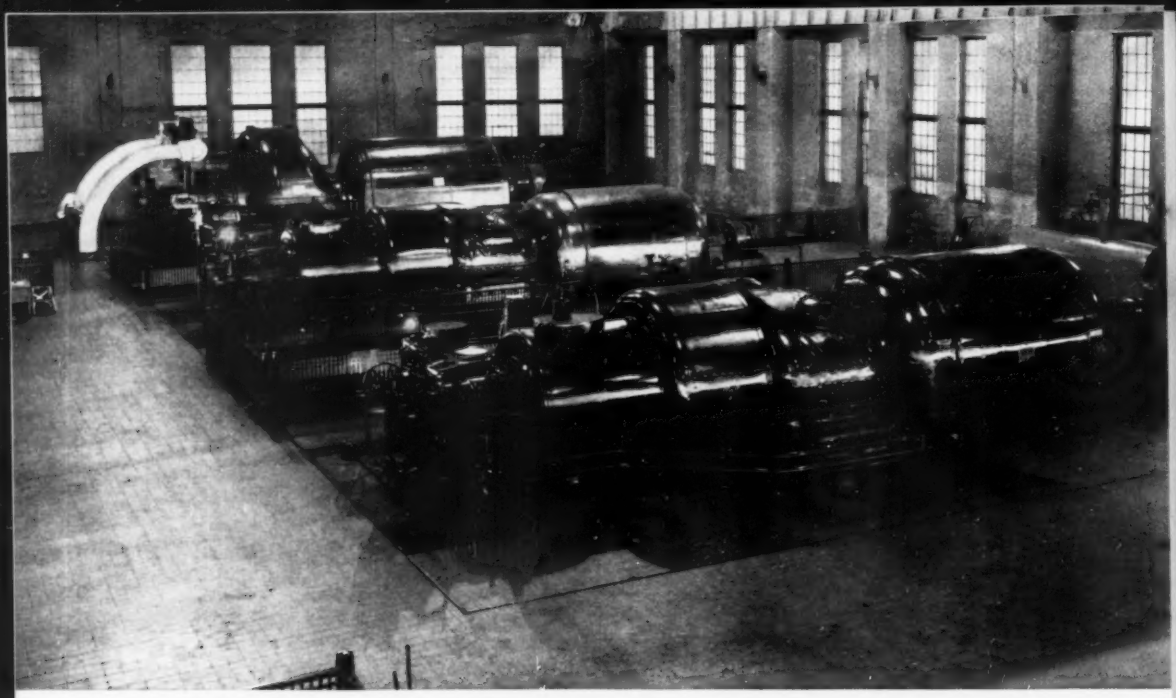


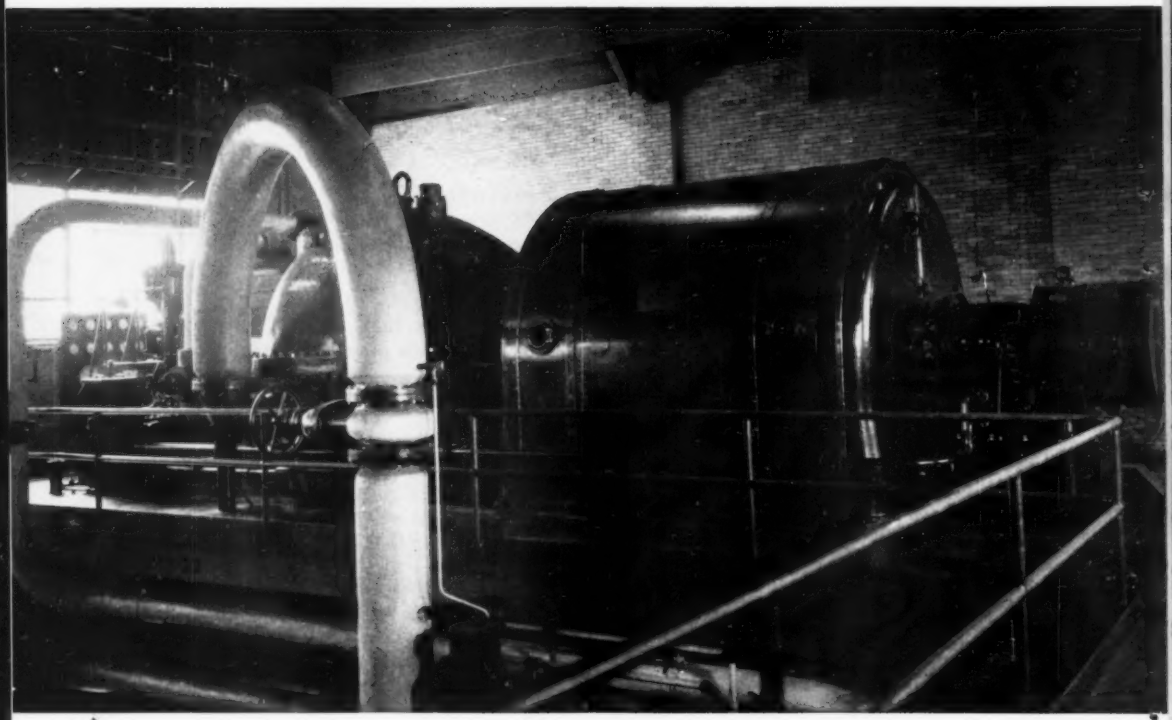
Reprints of eleven advertisements explaining the inter-relation of all water problems from selection of source to disposal of waste. If you would like a copy, just drop a postcard to Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

# HALL LABORATORIES, INC.

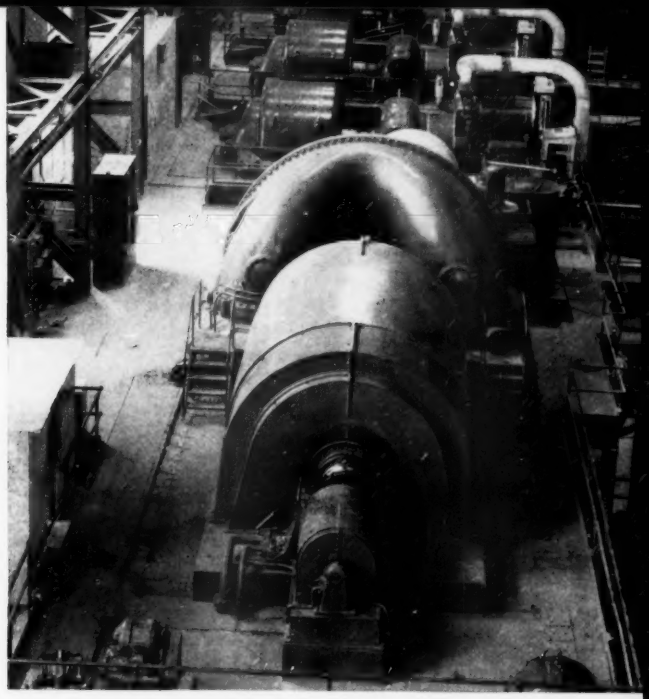
*(A Subsidiary of Hagan Corporation)*

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL





STANDARD OIL COMPANY (INDIANA)



# 21-year record shows economy of...

## NONPAREIL Turbine Oil

**"Will outlast your turbine"**

WHEN A LARGE COMPANY uses one turbine oil for over 21 years and in an increasing number of units, it's worth knowing why!

In 1927, the Carnegie-Illinois Steel Corporation put Nonpareil Turbine Oil into a 30,000 KW General Electric turbine. Today, this company lubricates sixteen turbines, having a total capacity of nearly 200,000 KW, with Nonpareil. What's back of the impressive acceptance of this turbine oil?

Here's the 21-year record for the company's first Nonpareil-lubricated turbine: *No oil replaced, no oil removed for treating, no need to clean the oil system.*

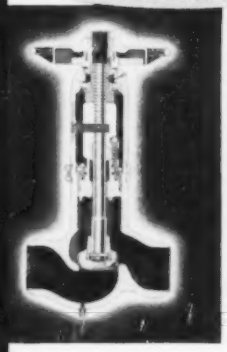
Such economical and reliable turbine lubrication has kept Carnegie-Illinois Steel officials completely sold on Nonpareil. Why not make their experience your basis for investigating Nonpareil's advantages? A Standard Oil Lubrication Engineer will supply you with information about utility operations on which Nonpareil has reduced lubrication costs as much as 68%.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

**STANDARD OIL COMPANY (INDIANA)** STANDARD

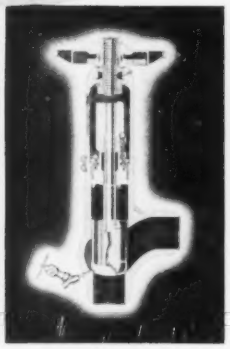
# AGAIN *it's Edward Valves*

## TYPICAL EDWARD DESIGNS GOING INTO THE NEW STATIONS



### CAST STEEL STOP VALVES

Edward builds globe and angle stop valves for service up to 2500 lb sp at 1000 F in sizes $2\frac{1}{2}$ to 16 in. Illustrated, 1500 lb pressure-seal bonnet globe type valve.

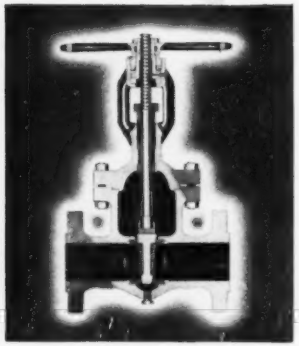


### CAST STEEL NON-RETURN VALVES

Edward globe and angle non-return valves are built for service up to 2500 lb sp at 1000 F in sizes $2\frac{1}{2}$ to 16 in. Illustrated, 1500 lb pressure-seal bonnet angle type valve.

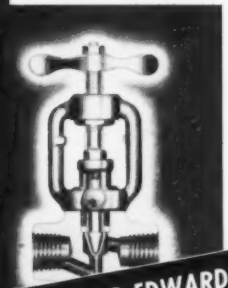
### CAST AND FORGED STEEL BLOW-OFF VALVES

Edward builds angle and straightway blow-off valves for service up to 1500 lb sp at 1000 F in sizes $1\frac{1}{2}$, 2 and $2\frac{1}{2}$ in. Illustrated, 300 lb flanged end straightway valve.



### CAST STEEL GATE VALVES

Edward gate valves are built for service up to 1500 lb sp at 1000 F in sizes $2\frac{1}{2}$ to 12 in. Illustrated, 600 lb flanged end gate valve.



### FORGED STEEL INSTRUMENT VALVES

Edward builds globe and angle instrument valves for service up to 6000 lb WOG or 1500 lb sp at 1000 F. Built in $\frac{1}{4}$, $\frac{3}{4}$ and $\frac{1}{2}$ in. sizes. Illustrated, $\frac{1}{2}$ in. screwed end globe type.

### CAST STEEL CHECK VALVES

Edward check valves are built for services up to 2500 lb sp at 1000 F, from $2\frac{1}{2}$ to 16 in. Illustrated, 1500 lb pressure-seal bonnet valve.

### FORGED STEEL STOP VALVES

At left: Union or bolted bonnet globe and angle type for services to 1500 lb sp at 850 F built in sizes from $\frac{1}{4}$ to 2 in.

At right: Welded bonnet globe type Univalve for services to 2500 lb sp at 1000 F built in sizes $\frac{1}{2}$ to 2 in.

### IS YOUR EDWARD CATALOG UP TO DATE?

Do you have a current Edward catalog in your files? If not, this coupon will bring you one without obligation.

**EDWARD VALVES, INC.**
**1220 West 144th St., East Chicago, Indiana**

Name_____

Company_____

Street_____

City_____ Zone_____ State_____

**Edward builds a complete line of steel power plant valves. Since Edward builds *only* steel valves, Edward research, all Edward engineering, all Edward manufacturing is directed toward the single purpose of making the best steel valves obtainable.**

# in over 95% of NEW POWER PLANTS !

## THE EVIDENCE!

**97 out of 102 (95.1%) of new central stations and municipal power plants scheduled to start operation in 1950 or earlier use Edward steel valves. (Source — 1949 McGraw-Hill survey of typical central station and municipal power plant installations)**

INDICATES PLANT USING EDWARD VALVES

Another Product

**Edward Valves, Inc.**

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

# *Low-cost operation*
# *Up-to-date design*

**THE REASONS WHY WORTHINGTON WATER SOFTENERS WERE SELECTED FOR THIS BIG GOVERNMENT HEATING PLANT**

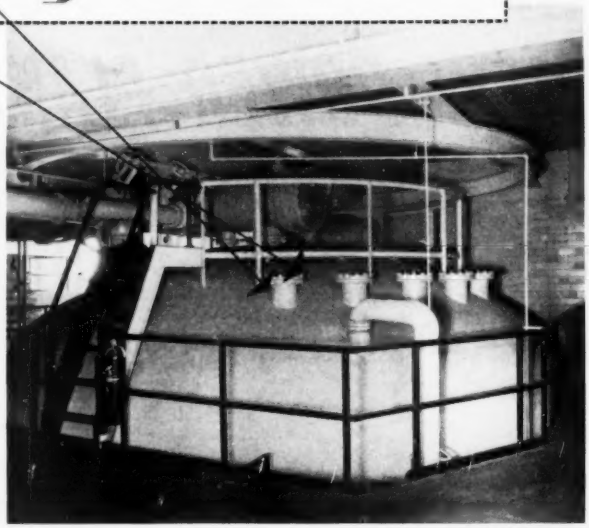
RECENTLY completed in Washington, D. C., the U. S. Government's West Central Heating Plant — which supplies neighboring administration buildings with vast quantities of steam — affords a striking example of the great technical advances made in this type of operation.

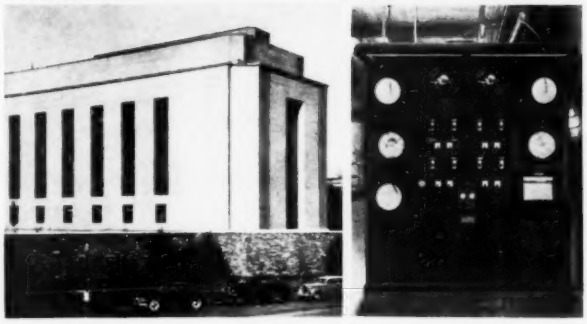
Protection against boiler scale and corrosion is provided by two Worthington Hot Process Deaerating Softeners. Each is rated at 640,000 pounds treated and deaerated make-up output, plus 175,000 pounds of deaerated condensate, for a total normal rated capacity of 1,630,000 pounds per hour of conditioned boiler feed water.

Selection of these two units was governed not only by the proved economies of the Worthington Hot Process System, but by the many advanced features of Worthington design. For example: spray jet deaerators and facilities for back-washing the filters with ideal water, without loss or disturbance to the softening process.

**To Cut Your Own Water-Conditioning Costs...**

Take advantage of Worthington's unexcelled experience in the design, manufacture and application of hydraulic equipment. And remember that Worthington, in offering a *complete* range of water softening units, enables you to place undivided responsibility in a single manufacturer . . . further proof that *there's more worth in Worthington.* Write for fact-full bulletins. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.*





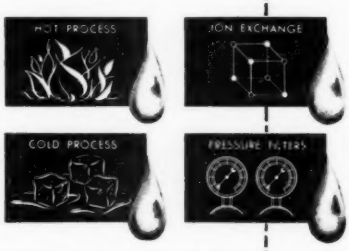
**Worthington-Equipped.** The Federal Government's West Central Heating Plant, Washington, D. C. Interior views show one of the plant's Worthington Hot Process Deaerating Softeners (with Vent Condenser) and the Control Panel for this installation.

J8.7

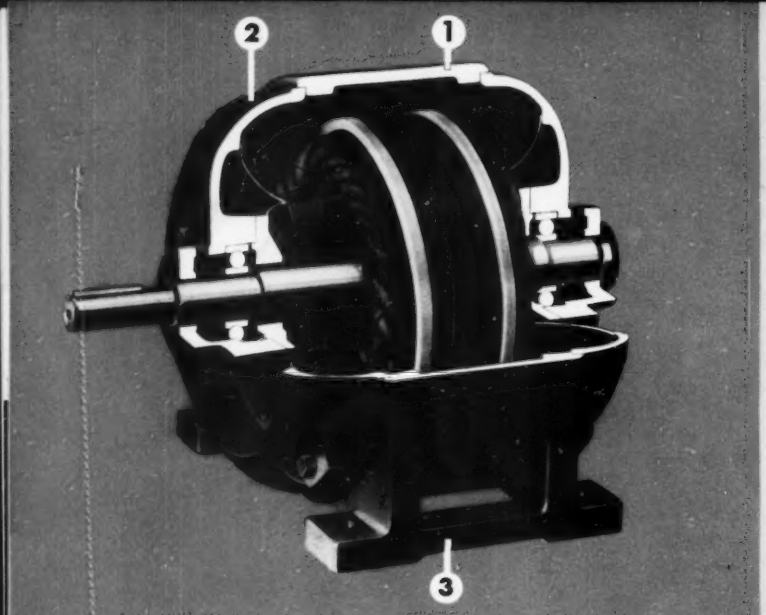
**WORTHINGTON**

**WATER CONDITIONING**

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



YOU CAN TRUST
A TRI CLAD MOTOR
TO TAKE ABUSE
GENERAL ELECTRIC
Here's
Why...




Notice the thick cross sections of a Tri-Clad's husky cast-iron stator frame (1) and end shields (2) . . . the integrally cast feet (3). Here you have a *rigid structural unity* that no other general purpose motor we've seen can match. Distortion of bearing alignment is well nigh impossible, even by severe blows, careless installation, or the heavy continuous radial loads some industrial drives impose. Notice, too, how Tri-Clad double-end ventilation provides *uniform* "air conditioning" throughout the motor.

# You can trust a *TRI CLAD* motor to take abuse

Teeth-rattling blows – accidental jarring – dripping liquids – they're all in a day's work for a Tri-Clad motor – the toughest general-purpose motor that hard-headed plant management can buy.

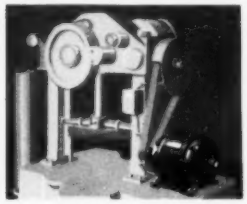
The cast iron structure which today protects more than a million and a half Tri-Clad motors, is one big reason for its stamina. It absorbs the shock of accidental blows and falling objects encountered in rigorous industrial service. It provides vastly superior resistance to rust and corrosion. Moreover, cast iron won't take on an injurious permanent "set"; thus it assures accurate shaft alignment and a permanent air-gap for the life of the motor. Thick-ribbed cast-iron end shields, too, take more than their share of punishment.

Want to standardize on a line of motors that can really **TAKE ABUSE?** Local stocks of Tri-Clad motors in your area mean **QUICK DELIVERY.** *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

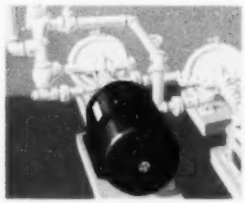
GENERAL ELECTRIC

758-11

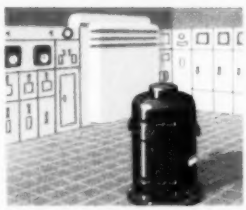
## YOU CAN'T BEAT TRI CLAD EXTRA PROTECTION



**G-E open (dripproof) induction motors** for constant-load, constant-speed applications. From 1 to 2000 hp.

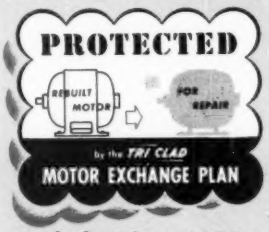


**G-E totally enclosed motors** for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.



**G-E vertical induction motors** for pump drive, in streamline design. From 1 to 500 hp.

**G-E capacitor motors** for use on fans, blowers, pumps and compressors, with single-phase power. From ¾ to 5 hp.

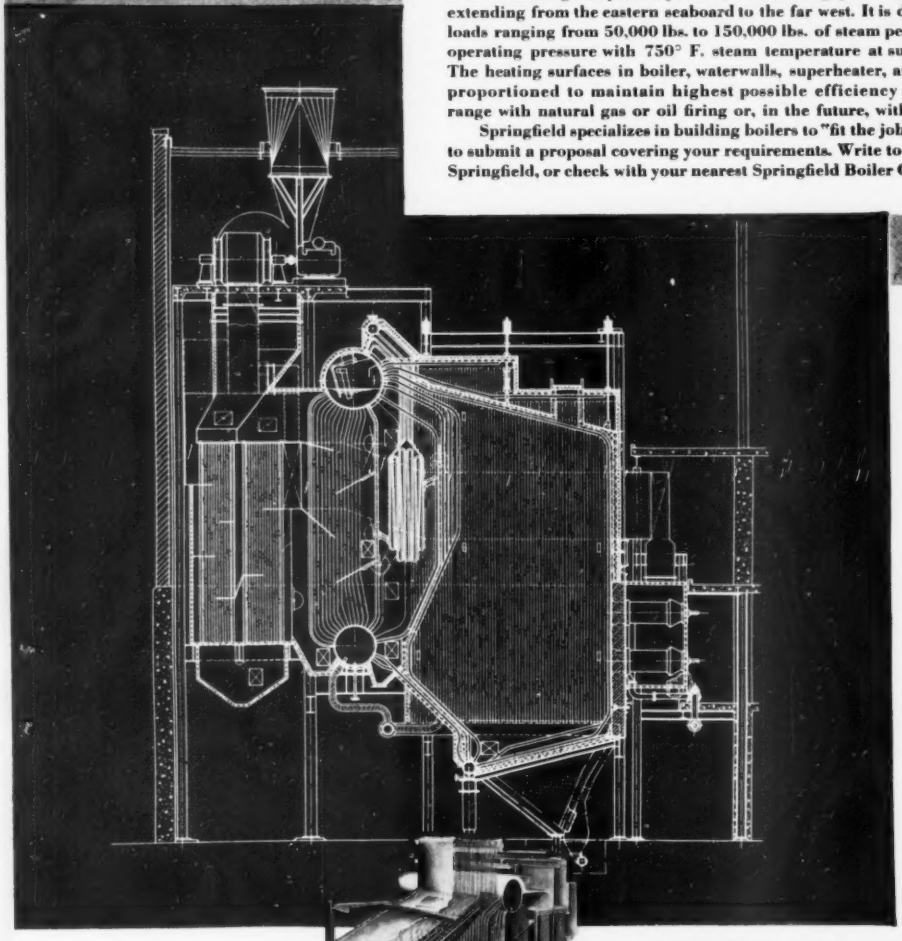



Look for this **EXTRA** on the motor you buy!

# COMPLETE STEAM GENERATOR

This new Springfield steam generator for municipal service in Colorado Springs, Colorado, is a typical example of the modern, economical units Springfield is building for power, process, and heating plant service in locations extending from the eastern seaboard to the far west. It is designed to handle loads ranging from 50,000 lbs. to 150,000 lbs. of steam per hour at 410 psig operating pressure with 750° F. steam temperature at superheater outlet. The heating surfaces in boiler, waterwalls, superheater, and air heater are proportioned to maintain highest possible efficiency over a wide load range with natural gas or oil firing or, in the future, with pulverized coal.

Springfield specializes in building boilers to "fit the job". We will be glad to submit a proposal covering your requirements. Write to our main office in Springfield, or check with your nearest Springfield Boiler Co. representative.

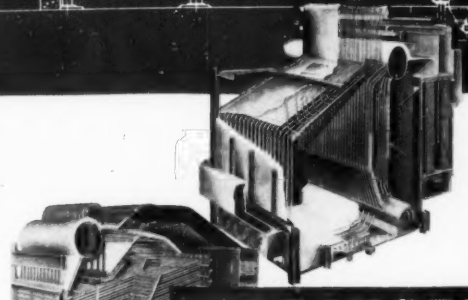


*Location:*
DEPT. OF PUBLIC UTILITIES,
Colorado Springs, Colorado.

*Consulting Engineers:*
LUTZ & MAY,
Kansas City, Mo.

SPRINGFIELD BOILERS

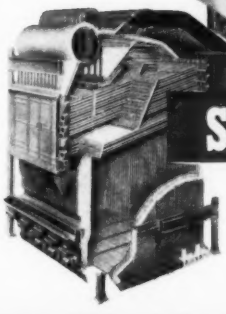
*CHECK WITH YOUR CONSULTING ENGINEER ON YOUR MODERNIZATION AND NEW PLANT PROJECTS*



## SPRINGFIELD PRODUCTS

BENT TUBE STEAM GENERATORS—Modern designs for capacities from 10,000 lbs. up.
STRAIGHT TUBE BOILERS—Specially designed for capacities from 5,000 to 450,000 lbs. per hour and higher.
STANDARDIZED TYPE MC BOILERS—Standardized for quicker delivery and lower cost. Sizes 7,500 to 17,800 lbs. per hour.
WATER COOLED FURNACES—Heavy duty water walls. Exclusive center water wall construction for larger units.
SUPERHEATERS — AIR HEATERS — ECONOMIZERS — Individually designed to meet requirements.

*See our catalog in SWEET'S*

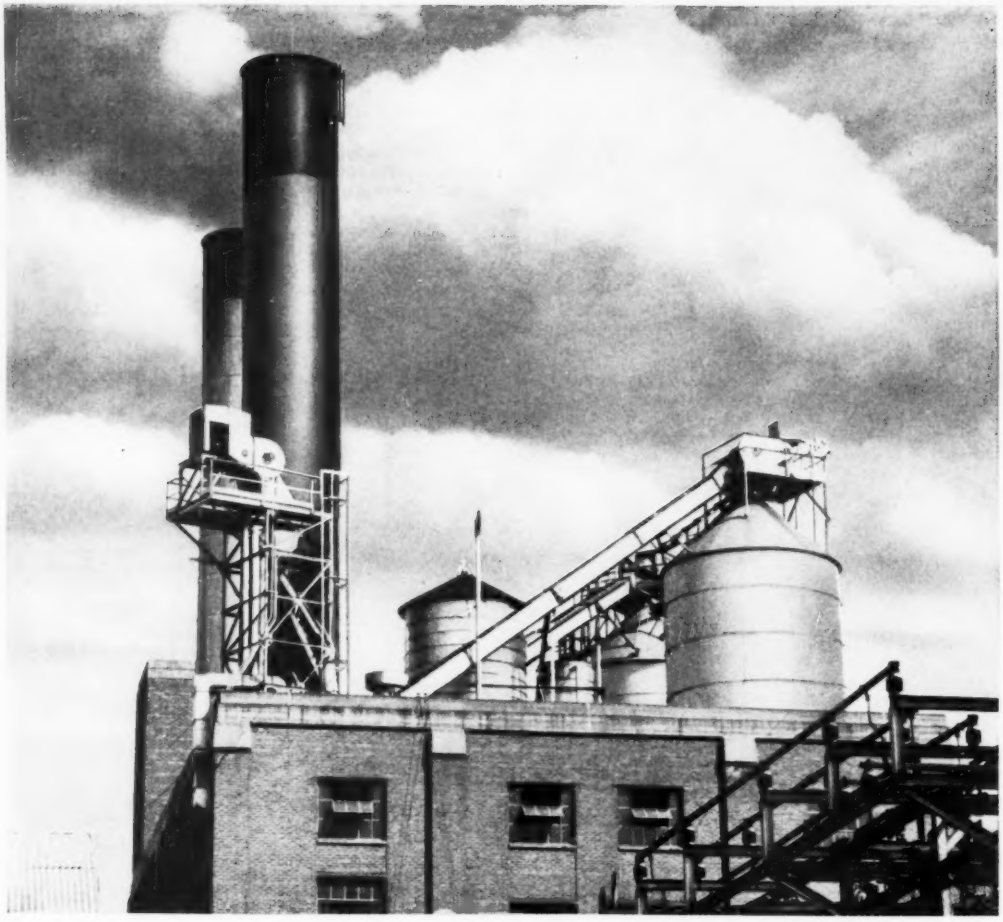


# SPRINGFIELD BOILER CO.

**1953 E. Capitol Ave., Springfield, Illinois**

***WORLDWIDE SALES AND SERVICE***

NEW YORK • PHILADELPHIA • WASHINGTON, D.C. • DETROIT • KANSAS CITY • HOUSTON
CHICAGO • ST. LOUIS • ST. PAUL • PORTLAND, ORE. • Export: READING, PA.



# Roof-Top Storage for Coal

A unique and convenient method for live storage of coal is used by this modern power plant located on French Island in the Black and LaCrosse Rivers. Roof-top storage bins fed by weatherproof REDLER conveyor-elevators are the standout feature of this compact system designed by S-A engineers for low-cost coal handling.

For nearly half a century S-A engineers have been designing and installing coal and ash handling systems for every kind of industry. From this wealth of experience have come constant improvement both in equipment and in methods.

Put these years of experience of S-A engineers to work on your coal and ash handling problems. Their recommendations will assure you maximum handling efficiency at lowest cost per ton. Write today.

*Coal is picked up from double track hopper by pan feeder which moves it to loop-boot feed section of 97 ft. high REDLER elevator. By meant of a gate regulated two-way spout, elevated coal is fed into two inclined REDLER elevators, each of which discharges into separate 180-ton capacity storage bins on roof of boiler house. Coal is spouted by gravity into stoker hoppers. Handling capacity of this S-A designed REDLER system is 60 TPH.*

**STEPHEN S-A DAMSON**

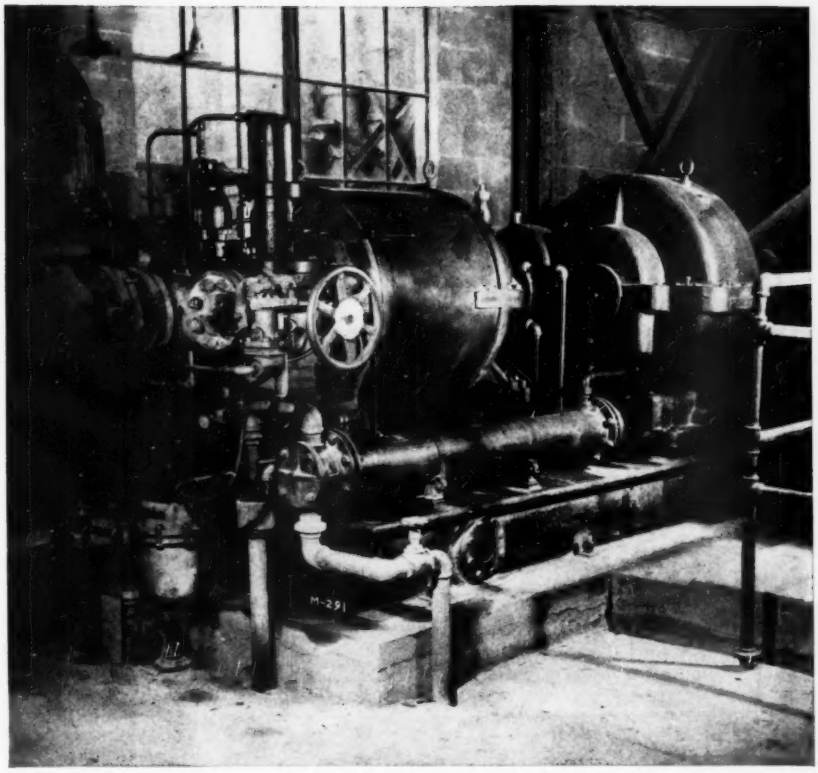
5 Ridgeway Avenue, Aurora, Illinois MFG. CO. Los Angeles, Calif. • Belleville, Ontario

**DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT**

NEWS

FROM THE POWER FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON




*Worthington Steam Turbine, Gear Reduction Unit and Multi-V-Drive at The Brockway Clay Company*

# Steam Turbine Saves Money, Space; Anticipates Future Needs

The Brockway Clay Company, an industrial leader of the Borough of Brockway, Pa., manufactures a wide line of vitrified clay pipe for draining and sewer use, together with many other clay products.

To furnish power to clay mixers, blenders and grinders used in preparing clay for processing these products, The Brockway Clay Company recently replaced a reciprocating steam engine with a 600 hp Worthington steam turbine and gear reduction unit.

The owner, Dr. H. E. Kilgus, and the consulting engineer, Zack C. Hinds, chose a turbine rather than another engine because of lower first cost, saving in floor space, lower building cost and the greater ability of the Worthington Turbine to cope with future steam and electric requirements.

The floor space required by turbine, gear and drive is approximately 50% of what a steam engine would require, and the foundation approximately 14%.

At present, the turbine drives, through gear reduction, a 36-belt Worthington Multi-V-Drive, thence a flat belt to line shafting. The turbine operates at 4580 rpm, and the gear reduces this to 720 rpm. Then the V-belt drive reduces the speed to 202 rpm, which is further reduced to 105 rpm by the flat belt drive. The turbine is presently operating at 140 psig steam pressure, 361°F, total temperature, zero back pressure, and in the future will operate at 200 psig steam pressure with 100°F superheat, at 2 psig back pressure. Exhaust steam, which will eventually be used in plant processes, now goes to atmosphere, but despite this, the saving in steam consumption is substantial when compared with the old engine.

The installation is so designed that a 720 rpm, 60-cycle generator may be added to the unit. This feature anticipates individual motor drives throughout the plant and the eventual operation of the clay presses by compressed air.

# NEWS from the power front

## Worthington Water Purifier Cuts Chemical Costs Over Forty Per Cent

The Riegel Paper Corporation's Milford, N. J., plant makes paper which is used for all types of food wrappings such as candy, bread and vegetables. This mill supplies the entire country.

Water supply comes from the Delaware River, and since it is hard, it has to be softened before it is used in plant boilers. This softening prevents scale formation and accumulation in boiler tubes. Until 1944, Riegel treated the incoming water chemically to reduce hardness. This method was effective, but the boiler tubes had to be cleaned two or three times a year for scale removal.

In 1944, Riegel installed a Worthington Double Unit Ion-exchange Process for water purification. With this new system, it is only necessary to clean the tubes once a year and this is done as a matter of routine in compliance with the request of the boiler inspector. Over 40% of the former costs with chemicals are thus eliminated. Scale accumulation in the boiler tubes has been practically nil.

*Worthington Double Unit Ion-exchange process at the Riegel Paper Corporation, Milford, N. J.*

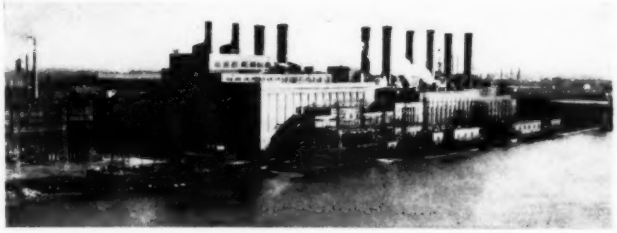
1,500,000 lbs. of Delaware River water are handled each day by the Worthington Double Unit Ion-exchange Process in preparation for steam requirements with a total exchange capacity of 392,000 grains. Each tank has a capacity of 200 gallons per minute. The only servicing or maintenance of the Worthington Ion-exchange units is the occasional regenerating of the purifying material.

## Five On The Line . . . Three On The Way For Niagara Hudson Power System

Buffalo Niagara Electric Corporation's Huntley Station, one of the largest *steam*-electric generating stations in the world, is located, surprisingly enough, only fifteen miles from Niagara Falls, the location of the largest privately owned hydroelectric station in the world. The Huntley Station, incidentally, generated more kwh during 1948 than any other *steam*-electric station in the world.

The company is part of Niagara Hudson Power System which is made up of three principal operating companies—Buffalo Niagara Electric Corporation, Central New York Power Corporation, and New York Power and Light Corporation. These three companies, together with The Niagara Falls Power Company, serve a large part of New York State outside of metropolitan New York.

Worthington condensers have been serving this company's 80,000 kw *steam*-electric generators for many years. In 1938, a 58,500 sq. ft. condenser was installed in the Oswego Station of Central New York Power Corporation. Since that time, two additional 58,500 sq. ft. units have been installed in this station and a fourth is on order. Two units of the same size are in operation at the Charles R. Huntley Station in Buffalo, while two units are on order for a new station at Dunkirk, N. Y., as part of Niagara Hudson System's plans to meet the continuing growth in power requirements of industry, homes and farms, and for reserve capacity.

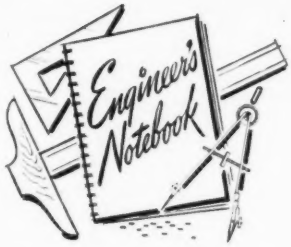


*Charles R. Huntley Station, Buffalo Niagara Electric Corporation, Buffalo, N. Y.*

Since 1938, the units installed in the three stations mentioned, represent the last word in power generation efficiency. Worthington takes great pride in playing an important part in this great System's program of keeping abreast of all technological developments.

Worthington Pump and Machinery Corporation
Harrison, N. J.

NEWS




# Another Worthington Contribution Toward Reduced Plant Construction Costs

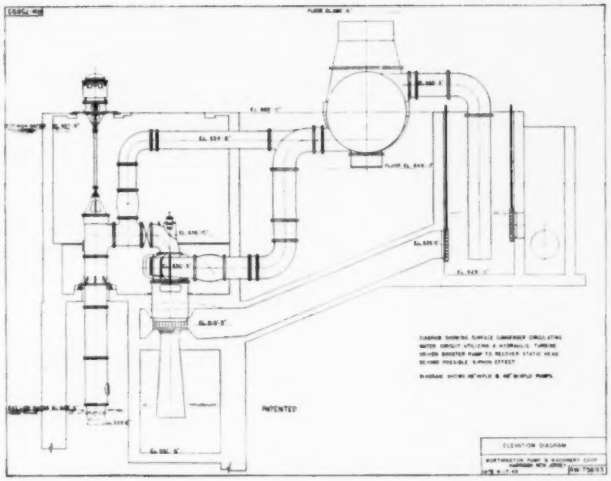
Worthington Pump and Machinery Corporation has under construction at their Harrison, New Jersey, Works a 70,000 square foot, two pass surface condenser and auxiliaries for the third unit of The Ohio Public Service Company's R. E. Burger Steam-Electric Station, located on the Ohio River at Dilles Bottom, Ohio. This plant is located well above flood stage, which has reached as much as 57 feet above extreme low water level.

The new condenser will serve a 90,000 kw nominally rated turbine-generator. Units #1 and #2 are 60,000 kw nominally rated, and each is served by a 46,000 square foot Worthington Condenser. Due to the successful operation of these first two units, the new unit will also use the patented circulating water system pioneered jointly by Worthington and the customer's Consulting Engineer, Mr. George W. Saathoff.

This unique system permits locating all major equipment, except circulating pumps, above flood stage, with but slight increase in pumping power requirements compared with a low-level plant, and avoids the expensive excavation and substructure cost of locating the condensers in deep pits to maintain normal pumping heads and at the same time keep the turbine-generator above flood stage. The long and large exhaust connection piece between turbine and condenser is likewise eliminated. All circulating and condensate pumps are vertical, with motors above high water, and all pumps are designed to operate completely submerged if necessary.

As illustrated in the accompanying diagram, two full capacity circulating pumps are used in series. The primary pump is a Worthington motor-driven HIFLO, submerged below extreme low water. The secondary or booster pump is a Worthington single suction volute MIXFLO, mounted directly upon, and driven by, an hydraulic turbine.

Advantage is taken of maximum syphon effect from the condenser discharge drop leg, which enters a sealing or control well, from which all of the circulating water is passed through the hydraulic turbine. Thus the static head from sealing well to river level is utilized in useful work, from 75% to 80% being recovered. This reduces the work required of the primary pump, with considerable saving in overall pumping horsepower.




In starting, the HIFLO pump with its high starting head characteristic is able to deliver enough water to the condenser for starting purposes. The bypass shown was omitted for Units 2 and 3 as the HIFLO can pump directly through the MIXFLO. When there is enough water in the control well, the hydraulic turbine is started and the HIFLO and MIXFLO automatically operate in series at full capacity.

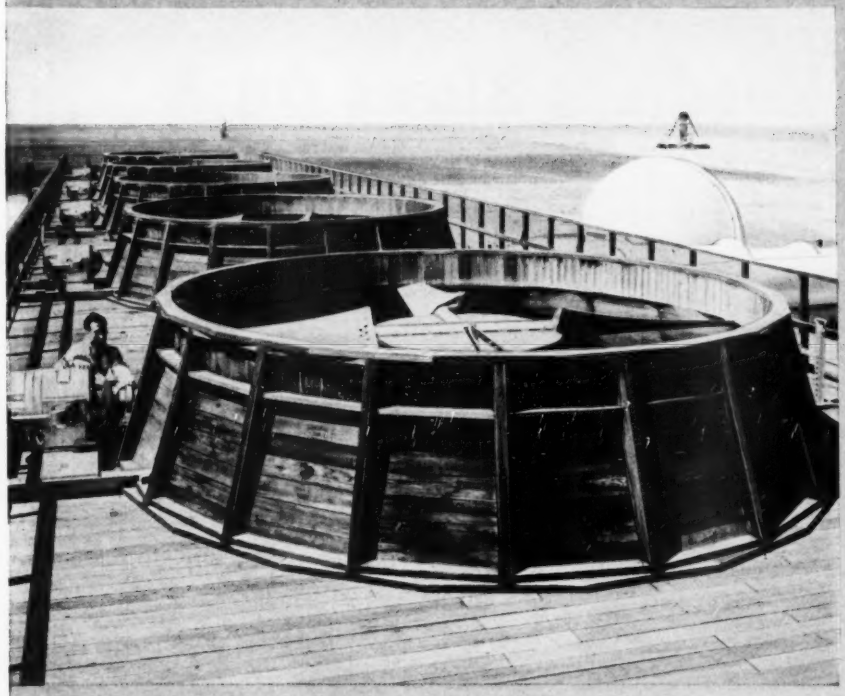
The booster pump functions until the river rises to such level as to render the hydraulic turbine ineffective, from which point the motor driven HIFLO operates alone producing full capacity under reduced head. Unit #3 will include two half-capacity primary HIFLO pumps, which will discharge through a single booster MIXFLO pump; thereby permitting operation of only one primary pump when low water temperatures prevail.

The system is ideal for installations where there is considerable fluctuation in water level, as occurs on some middle western rivers, and where it is desirable to locate the plant at considerable elevation above the source of circulating water supply, for reasons of lower construction cost, investment, accessibility, or geographical location.

9-14

# FOSTER WHEELER COOLING TOWERS

## on many landscapes—in many climates



The cooling tower shown here serves the high speed engines operating the 6 by 6 foot supersonic wind tunnel of the NACA's Ames Aeronautical Laboratory at Moffet Field, California. It is an induced draft type of tower which was designed by Foster Wheeler engineers for high efficiency in cooling. The flexibility of this design, now standardized, enables Foster Wheeler to engineer and erect cooling towers for the requirements of any load anywhere in the world.

**FOSTER WHEELER CORPORATION**
**165 Broadway • New York 6, New York**

FOSTER WHEELER

# "We Reduced Costly and Troublesome Shutdowns Due To Needless Blows On A Circuit Serving 3 Arc Welders"

## When We Installed ••

"In the Truck Service Garage in Casper, we have the job of servicing three 220 volt arc welders connected to a 60 ampere switch. Frequently all these welders are thrown on the line at the same time.

"This causes a heavy rush of current that generally blew the 60 ampere renewable fuses we formerly used to protect the circuit.

"The resulting shutdowns were very costly to our customer and troublesome to us.

"During 1947 we decided to see if Fusetron dual-element fuses would help cure the trouble and so installed three 60 ampere ones in the switch.

"That was many months ago but so far not one Fusetron fuse has blown on the starting current of the welders.

"You can take it from us Fusetron dual-element fuses really do eliminate needless shutdowns."

*Geo. Forster*, President
FORSTER ELECTRIC COMPANY,
Casper, Wyoming

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

### *Facts About FUSETRON Dual-Element FUSES*

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

# Fusetron DUAL-ELEMENT Fuses

with their

# 10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

## STOP *Wasting Time and Money —*

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

**FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION**

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

*Name* _____

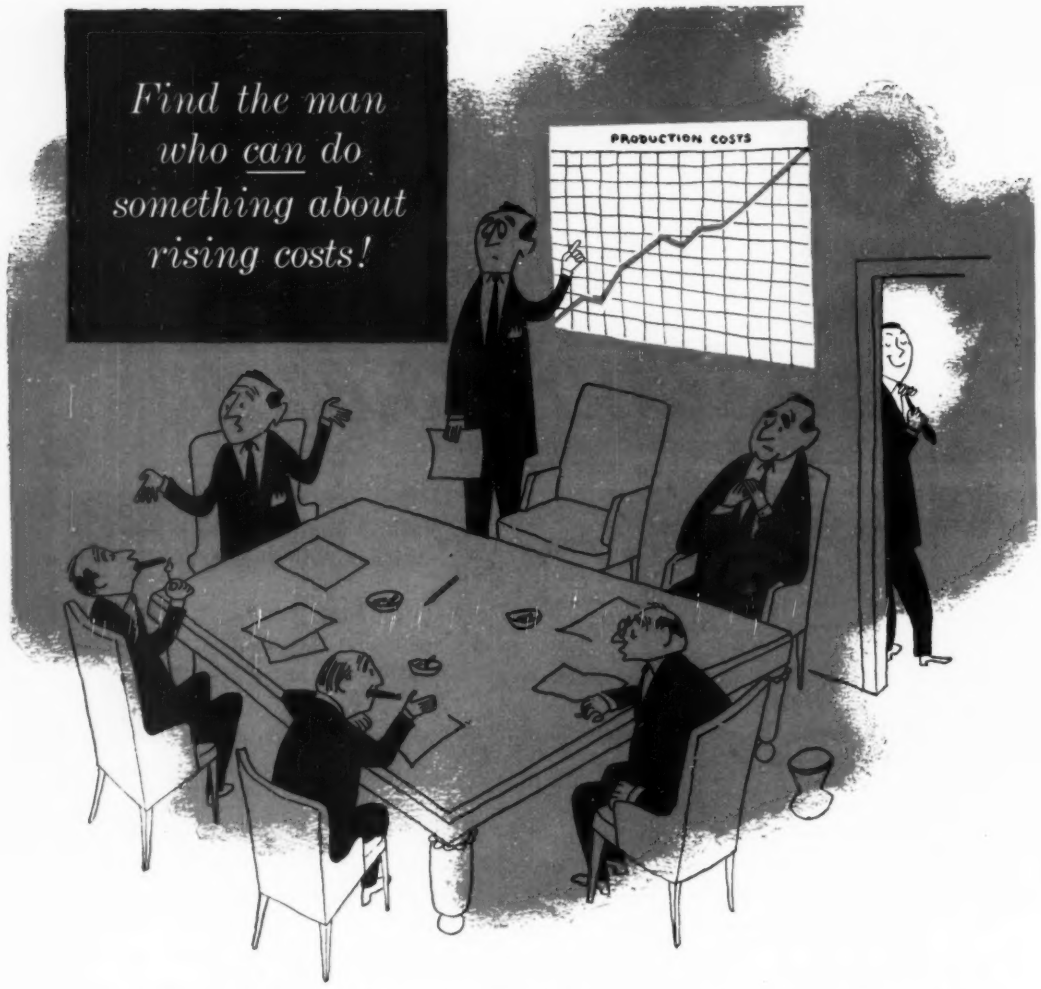
*Title* _____

*Company* _____

*Address* _____

*City & Zone* _____ *State* _____ 1149

# *Find the man who can do something about rising costs!*




**In most businesses,** operating costs are still on the rise. But there's *one* man who *can* do something about it—he's the man whose job is to get maximum heat and power from fuel dollars. He knows you *get* maximum efficiency from Eagle-Picher Industrial Insulations because they're made of durable, chemically and physically stable *mineral wool*, noted for its low conductivity. They give long years of service and are easy to maintain and replace.

There's an Eagle-Picher insulation that can help reduce *your* operating expenses!

*Let these Eagle-Picher products also save you money . . . power . . . time*

**Insulating Felts**
**Supertemp Block • Blankets**
**Loose Wool • Pipe Covering**
**Stalastic • Insulseal • Insulstic**
**Swetchek • Finishing Cements**
**Insulating Cements**

**THE EAGLE-PICHER COMPANY**

General Offices: Cincinnati (1), Ohio

*Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.*

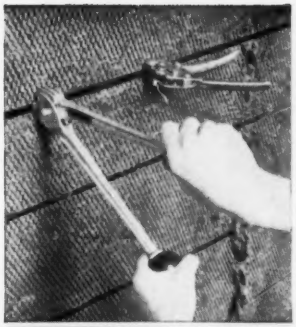
EAGLE EP PICHER

*Since 1843*

# *The perfect answer*

## FOR MAXIMUM FUEL SAVINGS AND EXACT TEMPERATURE CONTROL

For a completely effective, low-cost insulation combination, you can't beat the teamwork of Eagle-Picher Mineral Wool Blankets, Supertemp Blocks, Super "66" Cement and Insulseal. They work effectively to give your equipment higher efficiency . . . cut operating costs . . . and help to provide perfect, precise control over temperatures.



**EAGLE-PICHER MINERAL WOOL BLANKETS**

These blankets satisfy the need for a convenient method of quickly and efficiently insulating flat or curved surfaces on larger types of heated equipment. Mineral wool is felted and secured between flexible metal fabric. Outstanding physical and chemical stability enable Eagle-Picher Blankets to resist water, steam, corrosive fumes and normal vibration.

**EAGLE-PICHER SUPERTEMP BLOCKS**

Eagle-Picher Supertemp Blocks are lightweight (approximately 16 lbs. per cu. ft.). Can be cut easily with knife or saw to fit off-shaped areas . . . they fit snugly over minor irregularities. They're strong and have high refractory value. Withstand temperatures up to 1700 F. Conductivity at 512 F. approximately 0.43...all standard sizes, from 3" x 18" to 12" x 36" ...in thicknesses from 1" to 4".

**EAGLE-PICHER SUPER "66" INSULATING CEMENT**

Super "66" is all-purpose, rust-inhibitive, extremely adhesive insulating cement. "Springy ball" pellets don't collapse after application . . . give great coverage, retain their thermal efficiency. 100 lbs. covers 65 sq. ft. —1 inch thick! Easily applied with trowel, over flat and irregular surfaces. Efficient for temperatures up to 1800 F. Reclaimable when used on equipment whose temperatures go up to 1200 F.!

**EAGLE-PICHER INSULSEAL**

A tough, weatherproof, protective coating for insulation. For temperatures up to 450 F. Applied as a plastic, its smooth troweling qualities assure uniform coverage, proper thickness. It protects insulation from air infiltration, fumes, rain, snow, vibration, punctures, and withstands severe service, indoors or out. Dries to a smooth, rich black, has a neat appearance on hot or cold surfaces . . . may be washed or painted.

**THE EAGLE-PICHER COMPANY** *General Offices:* Cincinnati (1), Ohio

*Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.*

EAGLE EP PICHER

*Since 1843*

# . . . PIONEERS IN

# pd now present the

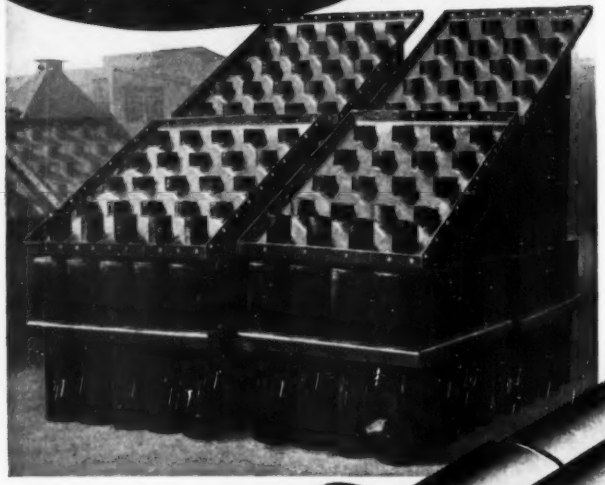


Fig. 3—VALMONT TYPE S Tubular Dust Collectors are made from standard, mass produced "building block" units of 25, 20 and 15 tubes each, sized for easy handling. All tubes are firmly welded in place at the factory, reducing the field erection costs by eliminating the need for field assembly of the tubes.

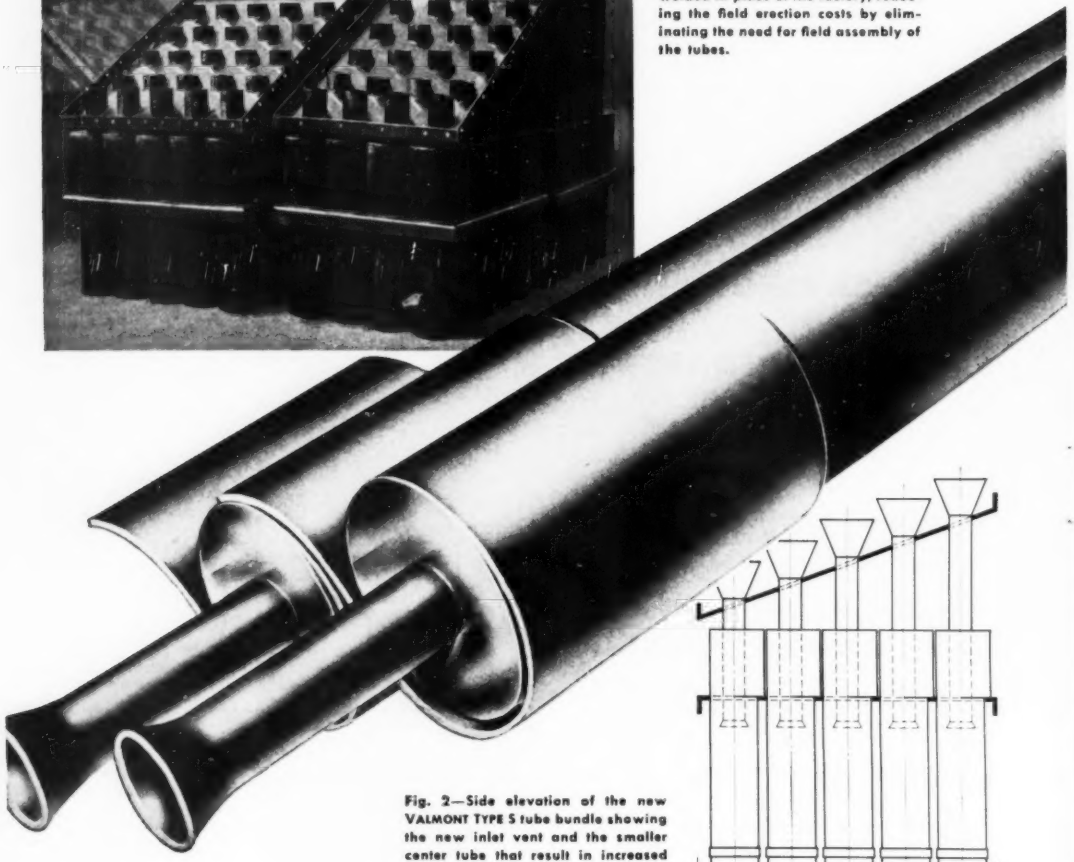


Fig. 2—Side elevation of the new VALMONT TYPE S tube bundle showing the new inlet vent and the smaller center tube that result in increased efficiency.

# PRAT-DANIEL

# DUST COLLECTION VALMONT TYPE S

Fig. 1—The VALMONT TYPE S tube, heart of a new high in mechanical dust collection efficiency. Radical changes, inside and out, have placed this collector in a class by itself.

## ...TODAY'S MOST EFFECTIVE MECHANICAL DUST COLLECTOR

The VALMONT TYPE S Dust Collector is an entirely new design, based on an old principle. It employs the basic patented P-D feature of introducing the dust laden gas through a narrow, high inlet. This thin ribbon of gas reduces the distance of dust travel to the inner wall of the precipitating tube, thus increasing the ratio of collection on ultra-fine particles (in the critical range of from one to twenty microns).

The VALMONT TYPE S is new in many details of design that have been thoroughly tested and proven higher in efficiency . . . smaller in space requirements . . . lower in weight and cost. Such as the aerodynamic S shape of the gas inlet—the changes in proportion of width to height of inlet—the reduction in the size of the center gas outlet tube equipped with a flare.

In addition, to increasing efficiency, these design changes permit a much closer nesting of the tubes. Cost, weight and space are reduced accordingly—and the reduction in cubical requirements is particularly desirable when the collector is installed on existing equipment.

The VALMONT TYPE S is mass produced in building block units of 25, 20 and 15 tubes each, with all tubes welded in position at the factory. Field handling and erection costs are thus reduced and maximum efficiency assured.

Our project engineers, The Thermix Corporation, will be glad to plan the new VALMONT TYPE S into your new plant, or show you how easily it will fit into your existing layout. For additional information on this new advance in dust collecting write for Catalog No. 250S.

***Project and Sales Engineers***

*(Offices in 28 principal cities)*

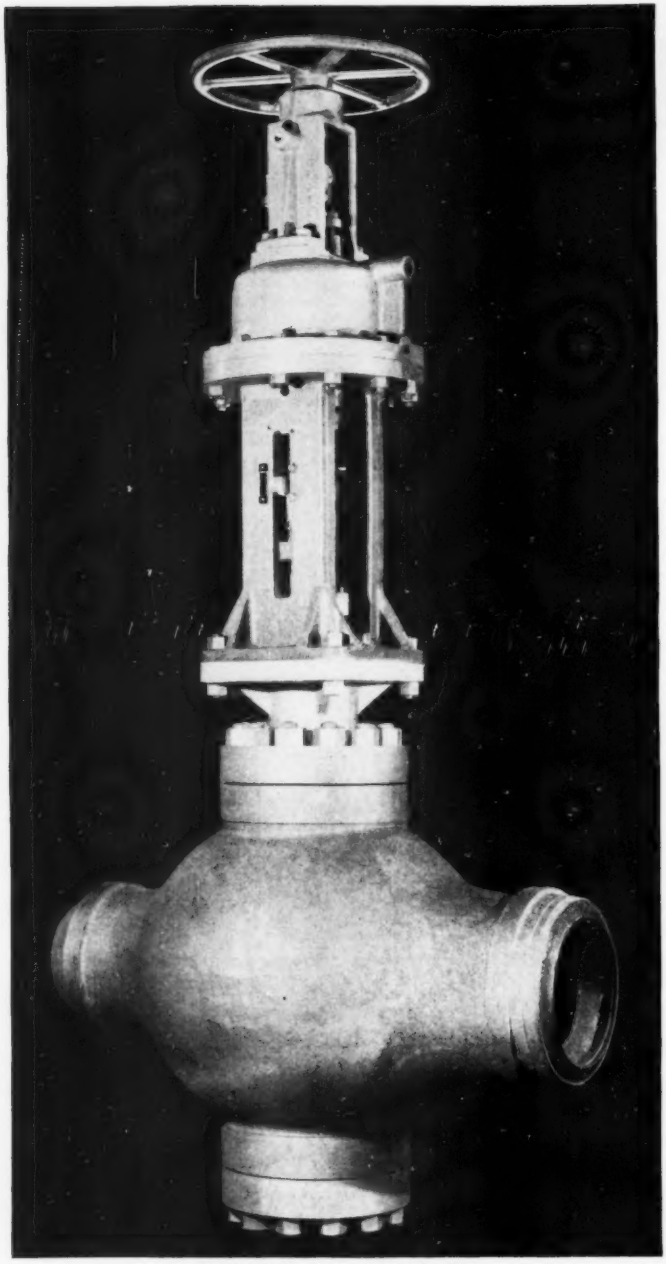
**THE THERMIX CORPORATION**

**FIRST NATIONAL BANK BLDG.** **GREENWICH, CONN.**

*Canadian Representative:* **T. C. CHOWN, LTD.**, 1440 Saint Catherine St., W., Montreal 25, Quebec

**CORPORATION**

**EAST PORT CHESTER, CONN.**



Republic 12 in. cylinder operated valve

# REPUBLIC

## GENERAL SPECIFICATIONS

- Built in all pressure standards—both flanged and welded ends.
- Streamlined flow through parts virtually eliminates erosion.
- Single seated valves—guaranteed drop tight.
- Double seated valves—guaranteed maximum leakage less than ½%.
- Steam valves have heat treated stainless steel trim with screwed in seats.
- Water valves have welded in seat rings with hard surface overlay—on small valves overlay is made directly on body.
- All valves are engineered to the job or application.

Republic 6 in. hand operated valve

# REPUBLIC FLOW METERS CO.

# VALVES REPUBLIC

## Regulating—Pressure Reducing—Shutoff

### CYLINDER OPERATED—double seated

Republic cylinder operated valves are of the gradual opening, high lift, double seated type. They are hydraulicly operated to assure smooth performance at any speed regardless of size, stattic pressure or pressure reduction. These valves are available in sizes from 3" to 24", with or without hand operating wheel. Due to compact design, a regulator may be mounted directly on the valve.

### HAND OPERATED—large sizes

Republic hand operated valves, in sizes from 3" to 8", are built to 900 lb. and 1500 lb. pressure standards. They are of the single seated type, have a one piece valve stem, and seat rings that are Stellite surfaced and welded in place. The gear reduction head is built with ball or roller bearings and precision ground gears for minimum friction and back lash. These valves are recommended for flow control and shutoff applications.

### HAND OPERATED—small sizes

Republic single seated hand operated valves are also available in 1", 1½" and 2" sizes, built to 600 lb., 900 lb. and 1500 lb. pressure standards. These valves also have a one piece valve stem, and a Stellite surfaced seat integral with the valve body.

### LEVER OPERATED—large sizes

Republic double seated lever operated valves are ideal for air actuation with long stroke cylinders. They are available in sizes from 3" to 16" for low pressure applications and in sizes up to 6" for 1500 lb. applications. The lever mechanism, of sturdy construction capable of taking full strains of power cylinders, is adjustable with full cylinder stroke to change valve capacity.

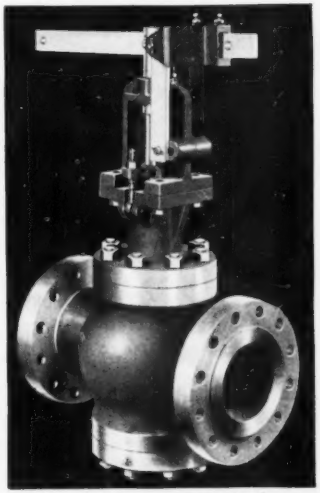
### LEVER OPERATED—small sizes

Republic single seated lever operated valves are available in sizes up to 2" and for pressures up to 1500 lb. standard. The valve seat is Stellite surfaced and integral with the valve body. The sturdy lever mechanism is adjustable for lift. Many of these valves are in operation on water lines with over 1000 lbs. pressure reduction

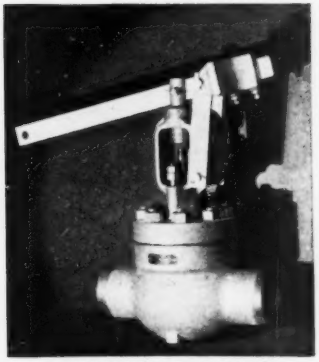
### BUTTERFLY VALVES

Republic butterfly valves can be supplied in cast iron or steel for pressures up to 300 lbs. Vanes can be supplied of the angle seating or swing through types. The shaft can be mounted on ball or plain bearings as required. A valve operator may be mounted directly on valves of 6" size and over.

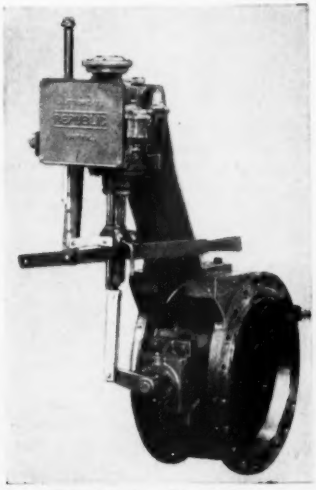
All Republic valves are engineered to the specific job on which they are to be used. Our engineers will be glad to consult with you on any of your valve problems. Write, asking to have one of our engineers call.



Republic 6 in. lever operated valve



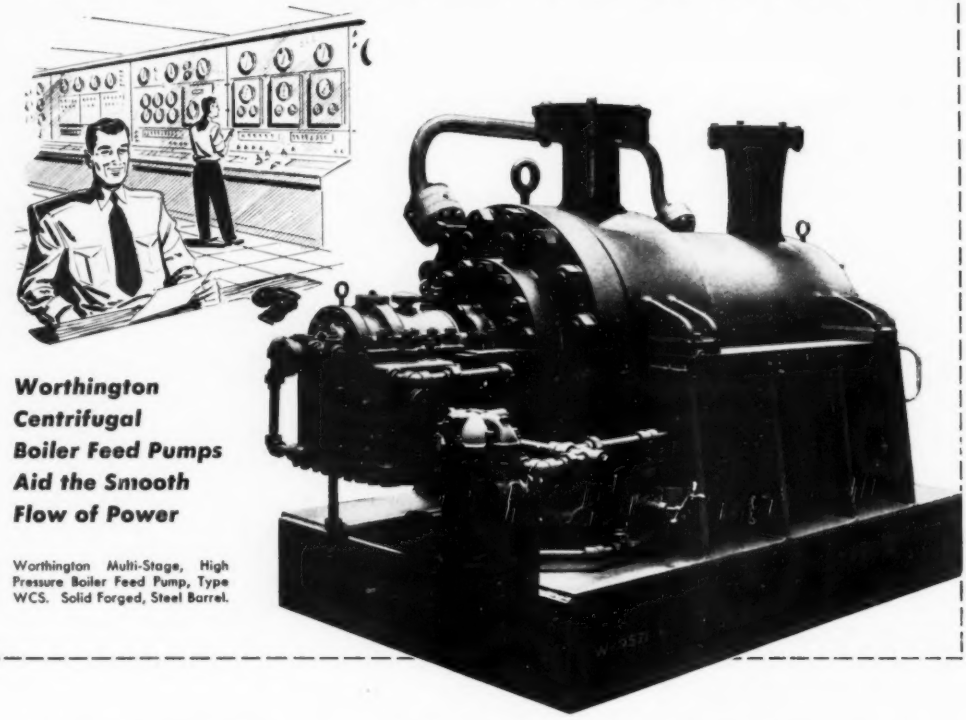
Republic 2 in. lever operated valve



Butterfly valve with operator

**2240 Diversey Pkwy., Chicago 47, Illinois**

# HERE'S DEPENDABILITY
## *your power dispatcher will appreciate!*



**Worthington Centrifugal Boiler Feed Pumps Aid the Smooth Flow of Power**

Worthington Multi-Stage, High Pressure Boiler Feed Pump, Type WCS. Solid Forged, Steel Barrel.

Your Power Dispatcher knows that to keep the kilowatts flowing out of the switchboard, smoothly and without a break, the boiler feed pumps must be in there pitching every minute.

To produce the most reliable and economical boiler feed pumps calls for highly specialized knowledge . . . of materials, to select the finest developed by modern metallurgy . . . of correct design, based on actual field experience . . . and of application, to fit the *right* pump to the job.

That's why control room men everywhere are grateful for the year-in and year-out dependability of Worthington Centrifugal Boiler Feed Pumps . . . and why more and more Central Stations are finding complete pumping satisfaction in these smooth-working aids to low cost trouble-free power production.

**THE WORLD'S WIDEST CHOICE**

is yours in Worthington's most complete line of Centrifugal Pumps. You can count on Worthington's expert engineering staff for valuable aid in choosing just the right size, pressure and capacity . . . still further proof of the *more worth in Worthington*. Call our nearest District Office, or write to: *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

# WORTHINGTON

C9-3

**THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB**

For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1000 Ft.
For Hotwell, Condensate, Chilled Water Service
Capacities to 1400 GPM
Heads to 650 Feet
For Boiler Feed Service
Capacities to 1300 GPM
Heads to 1600 Feet
For Water Works, Circulation, Drainage, General Service
Capacities to 135,000 GPM
Heads to 400 Feet
For Boiler Feed Service
Capacities to 1600 GPM
Heads to 3500 Feet
For Boiler Feed Service
Capacities to 3000 GPM
Heads to 7000 Feet

# These 7 Great Features Add Up To LONG V-BELT LIFE

**1** *Powerful Cord Structure* built up of hard-twisted, high tensile strength cords, impregnated with live rubber compound to prevent chafing and heating.

**2** *Thick, Resilient Cushion* of rubber supports cord structure at correct pitch line . . . absorbs shocks . . . helps dissipate heat.

**3** *Tough, double-wrapped cover* of long staple fibres, bias cut for elasticity and impregnated with rubber. Protects cords . . . seals out dust, grit, moisture.

**4** *Extra Stiffening Plies* of heavy fabric and rubber help keep the belt square in the groove.

**5** *Precision Molded And Cured* in accurate steel dies. Gives belt the *straight* sides necessary to provide the bulging gripping action that all V-belts need.

**6** *Every Belt Carefully Weighed* and inspected during construction. Assures perfect balance and uniformity.

**7** *Accurate Set Matching* . . . Every finished belt measured while running under load. *Texrope* multiple V-belts are matched in sets to assure uniform load on each belt.

## COMPLETE V-BELT SERVICE

Get everything you need for your V-belt drives . . . V-belts, standard and variable pitch sheaves and speed changers . . . from one reliable source. 144 page *Texrope* Pre-engineered Drive manual covers 90% of requirements. Get your copy today from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956. Also in Sweet's.

**ALLIS-CHALMERS, 952A SO. 70 ST.**
**MILWAUKEE, WIS.**

*Texrope* and *Super-7* are Allis-Chalmers trademarks.

Super-7 *Texrope* V-Belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices. A-2836

**Sold . . .**
**Applied . . .**
**Serviced . . .**

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

**MOTORS — ½ to 25,000 hp and up. All types.**

**CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.**

**PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.**

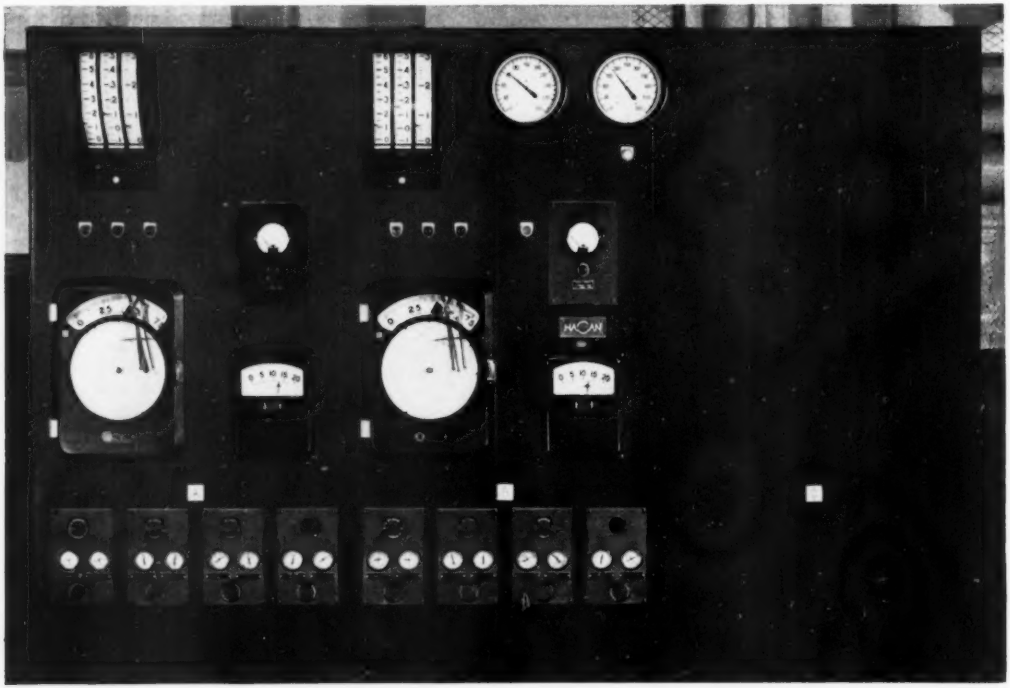
# ALLIS-CHALMERS

# New boilers, equipped with

# HAGAN Controls

## at JOHN B. STETSON CO.

In 1865, John B. Stetson, hatmaker, occupied one small building in Philadelphia. Today, John B. Stetson Company is the world's largest manufacturers of fine hats for men and women, with plants in Philadelphia, New York, Danbury, Connecticut, and Brockville, Canada. Stetson hats have become part of the American legend,—in the ballads and stories of the southwest, every hero's hat is a Stetson.



*Control Panel, showing three-pen indicating, recording and integrating Hagan Ring Balance Boiler Meters. Panel provides space for meter and control for a third boiler, to be installed later.*

# and Meters

Recent modernization of the Stetson Philadelphia plant included the installation of two oil fired boilers, with provision for a third—and this installation includes Hagan Combustion Control and Hagan Ring Balance Boiler Meters.

Steam is used in the hat making process, and to drive air compressors, vacuum cleaners and auxiliary equipment in the plant, and for heating the many large buildings which comprise the Philadelphia factory. The company also generates its own power.

The Combustion Control at the Stetson plant is a standard Hagan pneumatic system, including steam pressure furnace draft, and fuel-air ratio controls. Boiler meters are of the dual ring indicating, recording and integrating type, providing records of steam flow, air flow and stack temperature.

Hagan Controls and Hagan Ring Balance Meters are in service in plants of all types and sizes, in newly-built plants, and in modernized plants of long-established companies such as Stetson. For full information on these controls and meters, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

*General view of boiler room. United Engineers and Constructors, Inc., Philadelphia, Pa., were engineers and contractors on this installation, working with Stetson engineers.*

*Aerial photograph shows extent of the Philadelphia plant. Boiler room is in the foreground.*

HAGAN HALL BUROMIN CALGON

**HAGAN CORPORATION**

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

# *No job is too unusual for NAVCO*

NAVCO

Whether you require a simple pipe bend or a complicated prefabricated assembly, Navco can help you. As shown above, Navco Shops are equipped to handle Chrome Moly, Stainless, Carbon Steel and Copper, in addition to any of the many other Ferrous and Non-Ferrous materials.

## NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

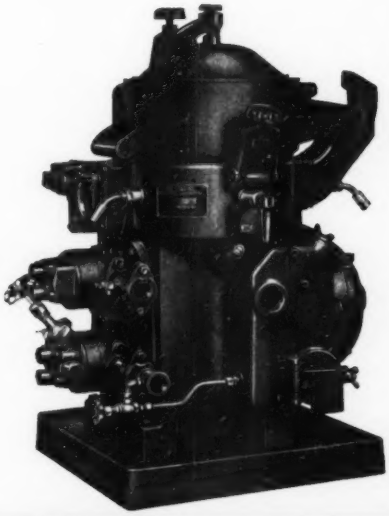
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

# I Do Both:

## Remove Dirt
## Eliminate Water

"I am De Laval Centrifugal Force. When I am put to work to purify lubricating oil—either turbine lube or Diesel lube—I do more than just remove the ***dirt*** present in the oil. I take out ***water,*** too!"

That's where De Laval Centrifugal Force differs from other means of maintaining lubricating oil. It does its job ***thoroughly***—the protection it affords against trouble from impurities remaining in lubricating oil is ***complete*** protection. No half-way measures for De Laval Centrifugal Force—the water is discharged continuously after being centrifuged out, and the dirt is stored outside of the zone where purification takes place.



De Laval Oil Purifiers have another advantage—enough reserve capacity to take care of a sudden emergency, such as a surge of water due to a leak.

***Write for additional information.***

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# De Laval

## LUBRICATING OIL PURIFIERS

AT THE
UPSON COMPANY
IT'S *Electrunite*

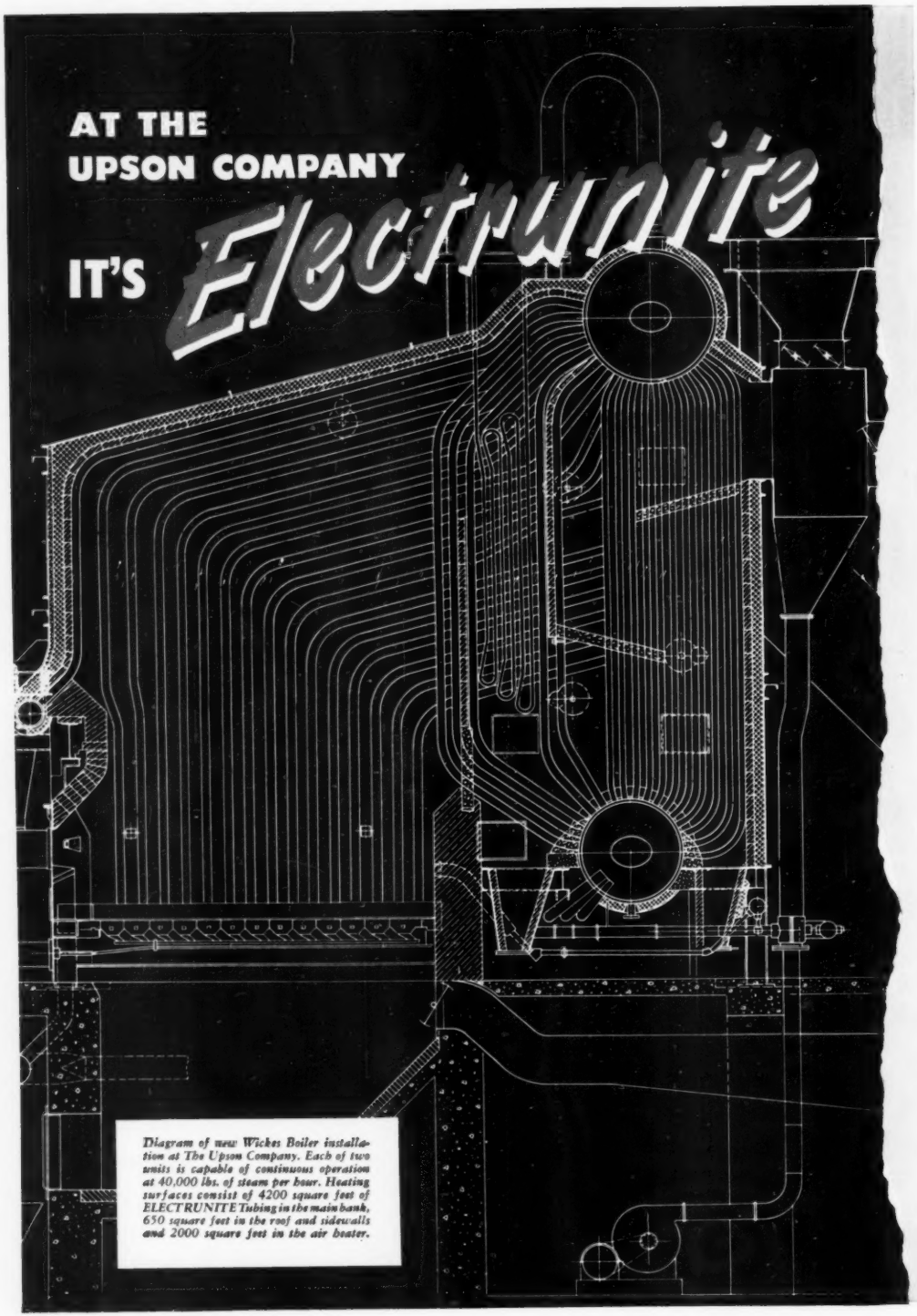


*Diagram of new Wickes Boiler installation at The Upson Company. Each of two units is capable of continuous operation at 40,000 lbs. of steam per hour. Heating surfaces consist of 4200 square feet of ELECTRUNITE Tubing in the main bank, 650 square feet in the roof and sidewalls and 2000 square feet in the air heater.*

# Boiler Tubes

## . . . FURNISHING DEPENDABLE, TROUBLE-FREE PERFORMANCE IN NEW WICKES BOILER INSTALLATION

The Upson Company, Lockport, N. Y., is one of America's foremost manufacturers of laminated fibre wall and ceiling panels. Regarding boiler tubes, Mr. A. P. Nutter, plant engineer, writes: "In our new boiler plant, we have endeavored to incorporate the best equipment available. In our opinion, ELECTRUNITE Boiler Tubes meet these requirements."

Here, again, is further proof of the wide acceptance of ELECTRUNITE Boiler Tubes and their preference by operating men responsible for dependable boiler performance.

Why this preference? . . . One important reason is that ELECTRUNITE is the *original* electric resistance welded boiler tube. Introduced by Steel and Tubes Division almost two decades ago, it is backed by years of production experience and assures you full satisfaction from every length of every shipment.

Just as Steel and Tubes Division stands out as the pioneer in the development and application of the electric resistance welding method of manufacture, so, too, does ELECTRUNITE stand out as the leader in the pressure tube field —supported by the performance records of more than 250,000,000 feet of boiler, heat exchanger and condenser tubing.

NOW, before specifying new or replacement tubes, is the time to get *all* the facts about ELECTRUNITE'S many cost-saving advantages. Write *today* for complete information.

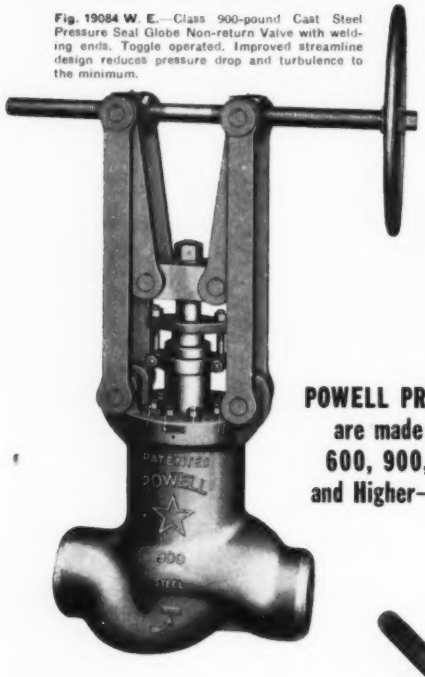
**REPUBLIC STEEL CORPORATION**
**STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO**
Export Department: Chrysler Building, New York 17, N.Y.

*This photo, one of two taken during boiler erection, shows section of top, side and rear water-wall ELECTRUNITE Boiler Tubes in new Wickes two-drum installation at The Upson Company.*

Republic
REPUBLIC STEEL
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

# You get *MORE* in Powell

Fig. 19084 W. E.—Class 900-pound Cast Steel Pressure Seal Globe Non-return Valve with welding ends. Toggle operated. Improved streamline design reduces pressure drop and turbulence to the minimum.




**POWELL PRESSURE SEAL VALVES are made in Pressure Classes: 600, 900, 1500, 2500 Pounds and Higher—all Commercial Sizes.**

Fig. 11323 W. E.— Class 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. Has top-mounted electric motor operator for quick, positive opening and closing by remote control.

Fig. 11331 W.E. — Class 1500-pound small size Cast Steel Pressure Seal Globe Valve with welding ends. This design permits practically unobstructed flow through the valve body thus reducing pressure drop and turbulence to the minimum.

# POWELL

# PRESSURE SEAL VALVES

Powell Pressure Seal Valves give you all the proven advantages of this type of construction, such as:

Bonnet-Body Joint stays tight under all operating conditions. The greater the internal pressure, the tighter the seal.

Lighter weight, because of absence of heavy bonnet flanges, bolts and nuts. Easier to handle and install. Application of insulation is simplified.

Valve can be assembled or disassembled more readily than the conventional bolted flanged bonnet type. Down time is cut to the minimum, and inspection of the valve is made easy.

Valves occupy less space because this construction permits making the end to end and center to top of stem dimensions considerably less than in the bolted flanged bonnet design.

But ***only*** in Powell Pressure Seal Valves will you find these additional, *exclusive* features:

**A greatly improved Pressure Seal Gasket.**
**A Hardened Steel Ring on top of gasket.**
**A readily removable Segmental Thrust Ring.**
**Lifting Lugs on yoke arms.**

*Again Powell leads in new valve design.*

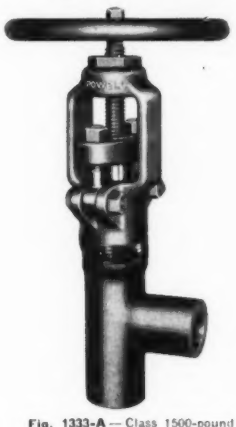


**Fig. 1333-A**— Class 1500-pound Steel Integral Bonnet Angle Valve with welding ends.

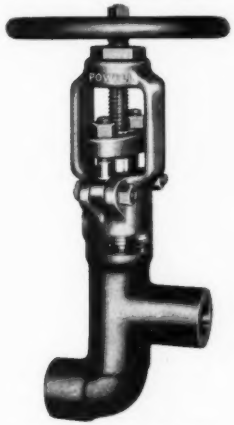


**Fig. 1331-A**—Class 1500-pound Steel Offset Globe Valve. Has integral bonnet and welding ends.

**Fig. 11313 W.E.**—Class 1500-pound Cast Steel Pressure Seal Gate Valve. Has venturied ports, welding ends and special by-pass. Bevel gear operated.

**Powell Pressure Seal Valves are available in GATE, NON-RETURN, CHECK, GLOBE and ANGLE patterns**

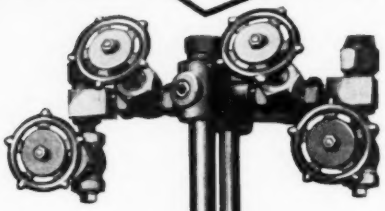
**The Wm. Powell Company**
**Cincinnati 22, Ohio**
**DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES**

# VALVES

# Now *ONE* EYE-HYE Model serves wide pressure range

**Model E600**
**0 to 600**
**Pounds**

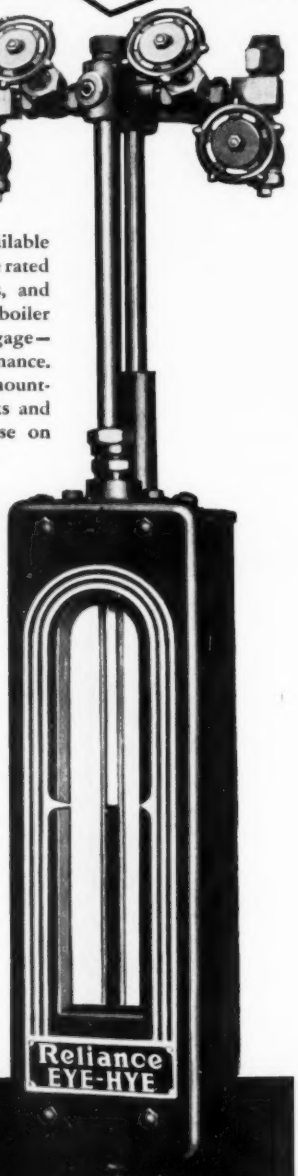
## If your boilers operate between 0 and 600 psi you can use the LOWEST COST MODEL OF THIS FAMOUS REMOTE READING GAGE



LATEST improvements in EYE-HYE design set new pressure brackets for the 4 basic models used with main boilers. Model E600 now provides dependable step-saving remote water level reading for the *largest numerical group of boilers—those operating at pressures up to 600 pounds.* Here is all-hydrostatic accuracy, simplicity (no mechanical working parts) and rugged construction, thoroughly proved in 13 years of satisfactory operation, available at moderate cost. • Other models are rated 601 to 900 lbs; 901 to 1500 lbs, and 1501 to 2000 lbs. Every type of boiler can be equipped with this reliable gage—easily installed, practically no maintenance. Made for wall or instrument panel mounting. Also models for auxiliary tanks and vessels. Thousands in approved use on both stationary and marine boilers.

**Model E900**
**601 to 900**
**Pounds**

**Model E1500**
**901 to 1500 lbs.**
**Model E2000**
**1501 to 2000 lbs.**



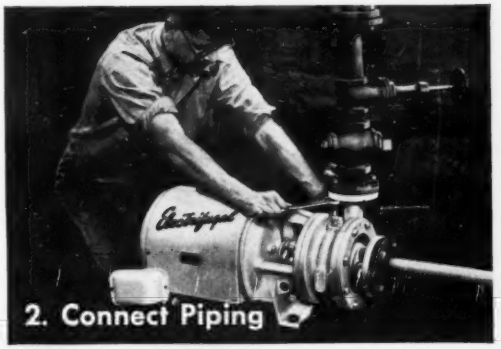

*Note:* **EYE-HYE comes complete with blow-down valves and UNITEMP temperature equalizing reservoir. Calibration is fixed at factory—cannot be tampered with in service.**

BOILER SAFETY DEVICES since 1884

# Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

Electrifugal PUMP



# 3 Easy Steps

## ...AND YOU'RE READY TO PUMP

- **No Alignment Problem**
- **No Extra Parts To Buy**

You save hours of expensive installation time with *Electrifugal* pumps because the pump and motor are built as a single complete unit, shipped READY TO RUN. Note that cast iron yoke and bracket for mounting pump are a *single-piece*—eliminating a separate adapter. And because motor and pump are on a *single* shaft, perfect and permanent alignment are assured. No couplings or other extra parts to buy. Maintenance costs less, too, because pump and motor cannot get out of alignment. Packing gland is readily accessible.

The Electrifugal pump, ranging from 10 to 1600 gpm with heads to 525 feet, is just one of many types of pumps built by Allis-Chalmers for industrial uses. You can count on the recommendations of the A-C pump application engineer. For information, see your Allis-Chalmers Authorized Dealer or Sales Office, or write for Bulletin 52B6059E. A-2769

*Electrifugal, Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

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***Applied . . .***
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**MOTORS** — ½ to 25,000 hp and up. All types.

**CONTROL** — Manual, magnetic and combination starters; push button stations and components for complete control systems.

**TEXROPE** — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

# correct

## FUEL-AIR RATIO
## FUEL FEED OVER-FIRE DRAFT

### GET ALL *Three* AND HAVE THESE RESULTS

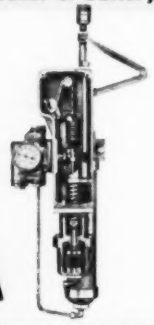
**1** More steam from your present boiler.

**2** Less fuel — coal — oil — gas required.

**3** Savings in maintenance whether you have a single boiler or battery of boilers.

WHETHER YOU HAVE ONE OR A BATTERY OF BOILERS . . . . INSTALL

## CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS



### CASH STANDARD FUEL FEED CONTROLLER • • •

***Automatically Regulates Fuel Feed***

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion —hence, money saving.

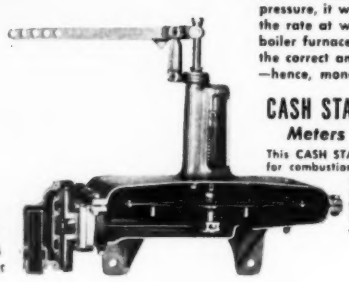
*Bulletin No. 300*
Shows Applications
Tells How the System Works in Your Favor

Tells about Correct fuel feed — Correct fuel-air ratio — Correct over-fire draft and how you get all three. It shows applications and how various CASH STANDARD Units can be made to meet any specific condition and work on any boiler or stoker with any kind of fuel.

•

*Send for it*

•



### CASH STANDARD AIR FLOW CONTROLLER • • •

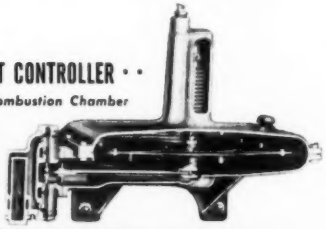
***Meters the Air Needed for Combustion***

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

### CASH STANDARD FURNACE DRAFT CONTROLLER • •

***Maintains a Constant Draft in the Combustion Chamber***

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



## A. W. CASH COMPANY
DECATUR, ILLINOIS

## CASH STANDARD CONTROLS . . VALVES

R/M Style No. 121

# R/M High Pressure Packings

The power engineer will find in the R/M line a variety of high-pressure and other packings for practically every power plant need.

R/M High Pressure Packing (Rubber Back)—Style No. 121—consists basically of asbestos cloth over a resilient core of asbestos and rubber. It is widely used for steam hammers and expansion joints, and for the piston rods and valve stems on steam engines, air compressors, and steam pumps.

R/M High Pressure Packing (Center Core)—Style No. 122—consists of a heat-resistant, resilient, rubber core covered by bias-cut asbestos cloth, lubricated and graphited. It is recommended for reciprocating steam or air rods, and valve stems. Also available with wire-inserted cloth.

R/M High Pressure Packing (Solid)—Style No. 124—is similar to Style No. 121, except that it is manufactured solid, without any core, for service in air and gas compressors, in furnace doors and similar applications.

Whatever your packing, gasket, or sheet requirements, consult your R/M catalog and call your authorized R/M packing distributor.

All R/M packings, gaskets, and sheets for maintenance and replacement are sold exclusively through authorized distributors.

**RAYBESTOS-MANHATTAN, INC.**

**Packing Division, Manheim, Pa.** | FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Rubber Covered Equipment • Powdered Metal Products • Bowling Balls

RM

# HEACON DAMPERS

Fig. 1—One of the 10 Heacon Dampers installed on 5 boilers, each furnishing steam for driving a 75,000 KW turbo-generator. Note size of Damper compared to man. Curtain is in an almost closed position.

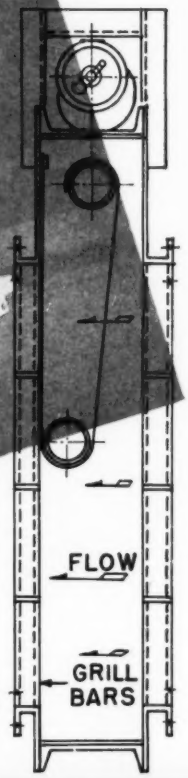



Fig 2—Cross section of Heacon Damper showing method of curtain operation. Curtain rolls on and off of the vertical grill. Duct pressure is borne by the grill and does not produce torque in the operating spindle. Smooth operation with modest power is assured.

Thermix
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# THE THERMIX

# increase output 6,720,000 KWH per year

# ...on this installation

How to clean one of two air pre-heaters (See Fig. 3) and keep the boiler at half load with the other F.D. fan and pre-heater, was the problem of this West Coast plant.

Equipment consisted of 5 boilers, each furnishing steam for driving a 75,000 KW turbo-generator. Cycle of the plant required that each boiler be on-the-line for 15 months, yet heaters required cleaning every 3 months. Louvered dampers allowed leakage of 550°F. air during cleaning periods, with the result that, every three months, each boiler was off-the-line completely for this operation!

One Heacon Damper installed in outlet of each air pre-heater solved the problem. Heacons now provide a complete shut-off of one air pre-heater for cleaning, while the other air pre-heater allows the boiler to operate at half load. The thermal strains encountered when such boilers and turbines are taken out of service and brought back on-the-line are avoided. Detail operations such as closing and opening damper, valves, drips, seals, lubrication lines, stopping and starting condenser circulation and feed pumps, fans, etc., are also eliminated. Members of the maintenance crew enthusiastically state that working conditions are highly satisfactory.

Heacon Dampers operate on the principle of flexible curtain sealing the flue area. (See Fig. 1 and 2) This principle provides liberal operating clearance for the moving parts without leakage, the foremost reason for the successful use of Heacon Dampers in applications such as this.

Additional information on this installation, applicable to new or existing equipment, is available on request.

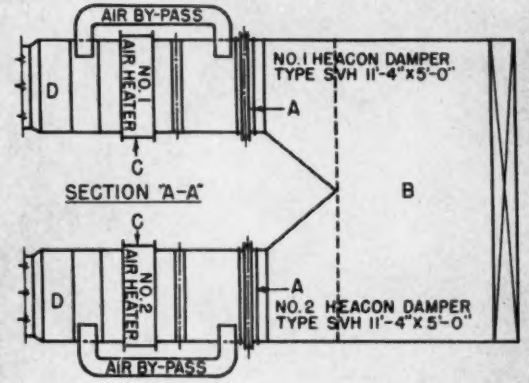
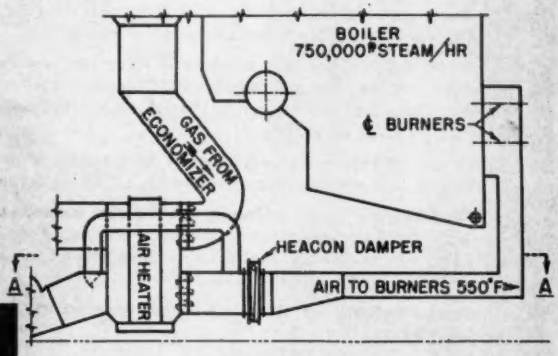



Fig. 3—A—Heacon Dampers, B—Common plenum chamber, C—Air-heaters, D—Blower. This schematic illustrates how the Heacon Damper shuts off the plenum chamber from the air-heater, permitting cleaning of one air-heater while the other is maintained on-the-line, to keep the boiler at half load.

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# IT'S EASY TO SERVICE

## A DE LAVAL TURBINE

## These features cut your maintenance costs

Every part of a De Laval Class CA Turbine is designed to facilitate inspection, maintenance and servicing.

**Casing and bearings split at center** line for easy removal. Rotor, carbon rings and bearings can be inspected without disturbing piping connections. Precision-machined casing joints require no gaskets.

**Outside adjustment for speed controls.** All you have to do is remove 2 cover plugs for access to the adjusting screws.

**"Rocking chair" governor pivots** seldom require replacement. The "rocking chair" type of governor pivot used by De Laval has no heavily loaded knife-edges subject to concentrated wear.

**Super-smooth chrome plated shaft journals** make carbon rings last longer.

**Maximum interchangeability of parts** between frame sizes.

De Laval Class CA Turbines are made in capacities from less than 50 to more than 1500 horsepower.

*SEND FOR CATALOG 4202-21-P*

**Before you buy a turbine, be sure and get complete information on these additional De Laval features:**

1. True center line support and flexible mounting for perfect alignment.
2. A choice of eight governors.
3. Balanced double-seated bonnet-type governor valves for close control of steam flow.
4. *Positive* over-speed protection entirely separate from normal speed governor for unfailing emergency shut-off.

**DE LAVAL STEAM TURBINE COMPANY, TRENTON 2, N. J.**

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TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

T-21

# POWER

CROSS-INDEX OF SUBJECTS FOR THE MONTH

**NOVEMBER 1949 • VOL. 93 • NO. 11**

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**TRANSMISSION, LUBRICATION**
**STEAM SERVICES, HEATING**
**INSTRUMENTS, CONTROLS**
**PUMPS, COMPRESSORS**

FEATURE ARTICLES

Careful planning produces training program that clicks ..... 74
Here are the working tools for flue-dust collection: I ..... 78
Magnetic drive controls textile mill's air conditioning ..... 82
Iron changes corrosion resistance of alloy condenser tubes ..... 84
Waste fuels produce about 90% of pulp mill's steam needs ..... 86
Radiant heating turns problems into progress ..... 90
Tackling electrostatic difficulties in industry ..... 93
Demineralizing 100% makeup for 1250-psi steam generator ..... 96
Skillful underpinning cures diesel foundation headaches ..... 102
Letters from a turbine specialist — 5 ..... 104
Condenser supports double-rotation unit ..... 105
Power — keystone of modern civilization ..... 108
Here's how circuit breakers should trip ..... 110
Handy charts simplify wood-fuel combustion ..... 112

DEPARTMENTS

Electronics — 19: One- and two-stage amplifiers ..... 115
Power engineer's notebook of plant-tested ideas ..... 120
Problems fresh from the plant ..... 124
Technical briefs for busy power men ..... 128
News of the power field ..... 132
Data sheet: How to figure centrifugal force ..... 136
Plant-equipment news ..... 138
Engineer's bookshelf ..... 148
George Edwards ..... 146
Reader's literature ..... 184A

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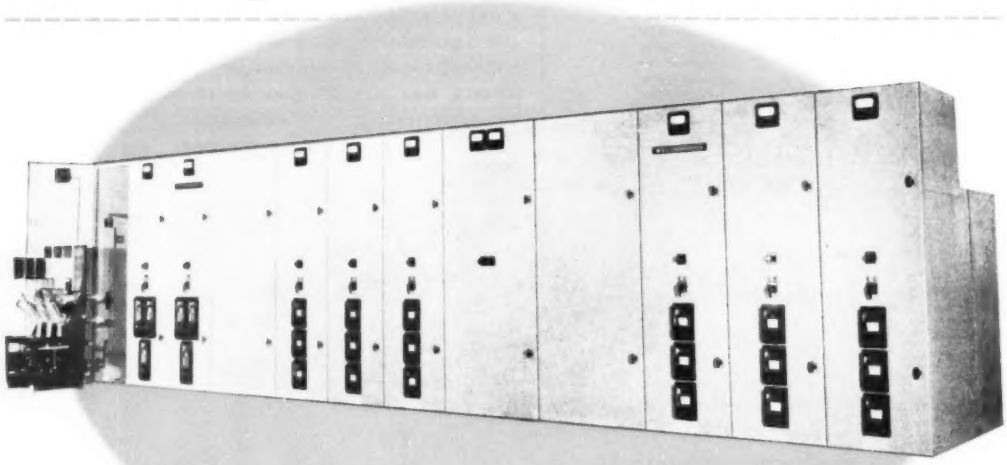
YOU CAN BE **SURE**.. IF IT'S

Westinghouse



## STANDARD Switchgear

## for the control of FEEDER CIRCUITS

*provides* **FLEXIBILITY FOR EXPANSION AND CONVERSION**

If your installation is made up of Westinghouse standard units, you are always ready to expand or convert. Additions to installed switchgear are made with comparative ease. Individual units can be moved quickly and economically when power requirements change. Be prepared for tomorrow while you get these vital advantages today . . .

**FASTER DELIVERY**
**LOWER COSTS**
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**LESS MAINTENANCE**

For "custom-built" benefits with none of the headaches, choose Westinghouse *standard* units. Get answers to your questions, plus complete information, from the new switchgear booklet. Ask your Westinghouse representative for B-4016, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60708

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"HEAVY-DUTY"

**METAL-CLAD SWITCHGEAR**

YOU CAN BE **SURE**.. IF IT'S

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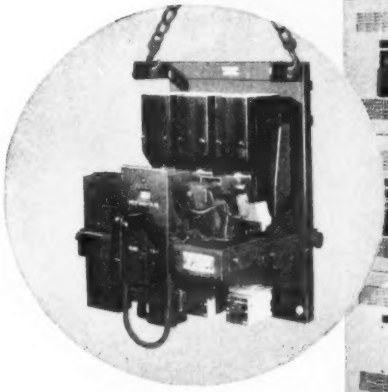
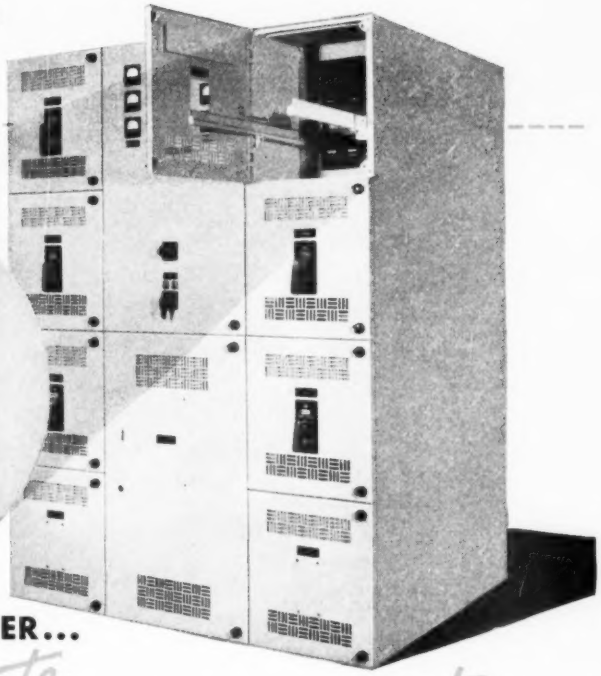




**ON THE LINE QUICKER...**

*with 3-Minute Breaker Replacement*

## Westinghouse "*UNITIZED*" Low-Voltage Switchgear

"Unitized" drawout construction assures maximum continuity of service. Breakers are disconnected, inspected and replaced in a matter of minutes . . . getting units back "on the line" faster.

"De-ion" air circuit breakers perform repeated interruption without appreciable change of their operating characteristics. Drawout construction keeps inspection time to a minimum . . . makes it easier to keep breakers in good operating condition.

For all switchgear applications up to 600 volts, Westinghouse builds ten basic units that meet every requirement. This "Unitized" method of construction eliminates special design and engineering costs . . . yet, gives the flexibility of a custom-built installation.

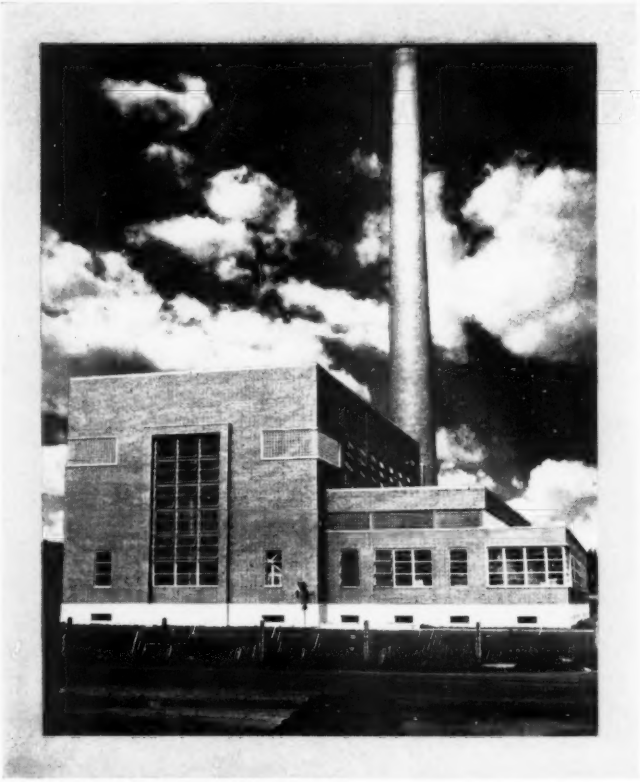
Find out how "Unitized" low-voltage switchgear can improve your operation. Ask for your copy of Booklet B-2296-D. B-4067 also gives the complete story on the new DB Breaker, illustrated above. Get yours today from your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-60713

Westinghouse

"UNITIZED"

LOW-VOLTAGE SWITCHGEAR

# This hospital power plant cures pipe ills with BYERS WROUGHT IRON



Since water is the life-blood of every power plant, an unfailing supply is of first importance. In the recently-completed plant at the Kankakee (Illinois) State Hospital, the job of safeguarding this service was entrusted to wrought iron. Over thirty tons of Byers Galvanized Wrought Iron pipe, in sizes from ½ to 8-inches, was installed in the supply system, and in extending the water distribution system in certain adjacent areas. The material was already being utilized for maintenance work on condensate return lines in the steam distribution system.

Power plants in all sections of the country are using this same time-tried method of protecting water lines. The wisdom of the choice is confirmed by many comparative records of wrought iron still serving in water lines after thirty—forty—and even fifty years, in areas where low-first-cost piping materials required repairs and replacement in a fraction of the time. The condensate return application is another that follows established engineering precedent. Condensate is always aggressive, and wrought iron has proved itself remarkably successful in resisting attack.

The corrosion-resisting properties of wrought iron are the direct result of its unusual composition and structure, which are duplicated in no other material. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and disperse corrosive attack. These fibers also help to anchor the initial protective scale, which shields the underlying metal.

It is helpful, in applying wrought iron in the many places where it can reduce repairs and maintenance, to know something of how it is made, how it resists corrosion, and where it has been used. All this is digested in the booklet, THE A B C's OF WROUGHT IRON. May we send you a copy?

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, San Francisco. Export Division: New York, N. Y.

*Corrosion costs you more than wrought iron*

**BYERS**
**GENUINE WROUGHT IRON**
**TUBULAR AND HOT ROLLED PRODUCTS**
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • NOVEMBER 1949 • ESTABLISHED IN 1882

# The Age of Instruments

DURING AND BETWEEN WORLD WARS it has become the American habit to read about what's wrong with the world—of which there always seems to be enough, coming and going, to fill the editorial columns of the newspapers.

To see a lot of what's right with the world mark your calendar for Buffalo, N.Y., Sept 11-15, 1950—the next annual Instrument Show. This advice is for those who missed the Philadelphia Instrument Show last year and the St. Louis Show this September.

The average instrument or control device is small, and the Instrument Society of America is less than five years old, yet the 140-plus exhibits at St. Louis covered 20,000 sq ft in the big civic auditorium.

But these numbers don't tell the story. You have to see one of these shows to understand the wonderful thing that is happening to American industry—the amazing perfection and expansion of instrumentation. Then you will sense how fast we are moving into the third stage of the power age. First, it was just the machine age. Next, it was the machine plus pushbuttons. Now it is clear that most of the buttons are going to be pushed by other "machines," so operation will become a matter of supervising the instruments and controls that run the plant.

Like power itself, instrumentation is something fundamental and universal. When you see where it stands today you will draw many far-reaching conclusions. Here are some impressions from St. Louis:

1—Who said small business is on the run? Most of the instruments and controls shown at St. Louis, including some of the most ingenious and elaborate, are products of small firms—most of whom don't seem to worry very much about the competition of big business.

2—Instrumentation will continue its rapid growth, not merely because Americans take to gadgets, but more because hard-headed business management sees more automatic control as the road to solvency and profits in the face of high labor rates and keen competition.

3—For obvious reasons, the military and other government branches will encourage instrument progress and contribute greatly to it.

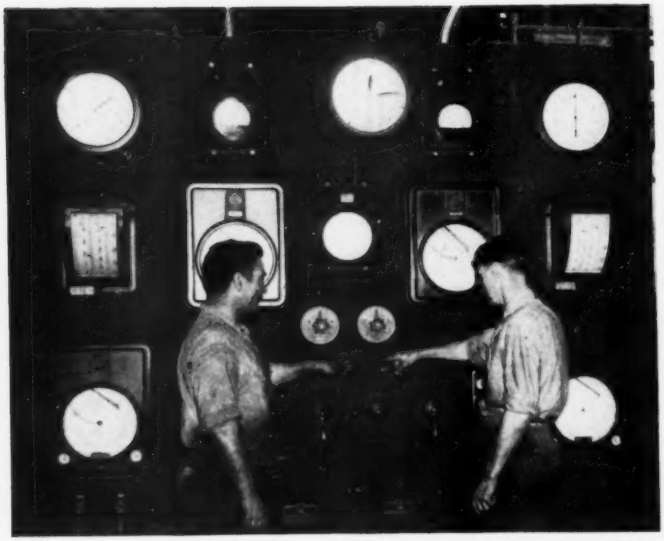
4—Yet most of the progress will trace right back to ingenious individuals in industry, supported by progressive business management.

5—As the years roll by, plant operation will call for less and less muscle, more and more instrument savvy. Even the smallest plants will come around to automatic control.

6—While instrument engineering has become highly specialized, the average power engineer will find long-known principles at work—orifice, venturi, pitot tube, diaphragm, metal bellows, bourdon tube, thermocouple, hot wire, liquid column—plus a few new ones, such as the magnetic property of oxygen.

7—Of course, the oldtimers will have to brush up on electronics.

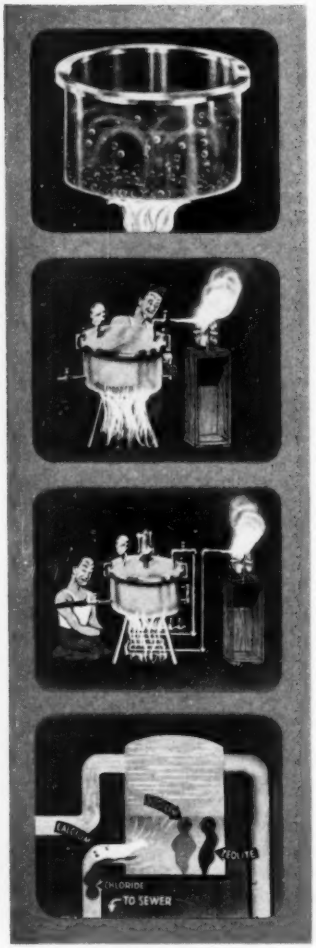
8—Will all these automatic controls take the fun out of life for men who like to work with machines? Why should they? There will still be planning, installation, maintenance, repair of all equipment, plus the really high-class mechanical and electrical jobs of keeping instruments and controls in top-notch working condition.



**BILL METZ**, Camden power-plant foreman (right), instructs Mike Monteleone, boiler-house maintenance mechanic, on the operation of the boiler main control board

**COMPARING NOTES** at the Lancaster plant. Karl Aument, Clair Mowrer, Dick Wickert, John Bradley, Herbert Shaub, John DeVerter, Edgar Eidemiller and Donald Glenn

**SAMPLE VIEWS FROM...**



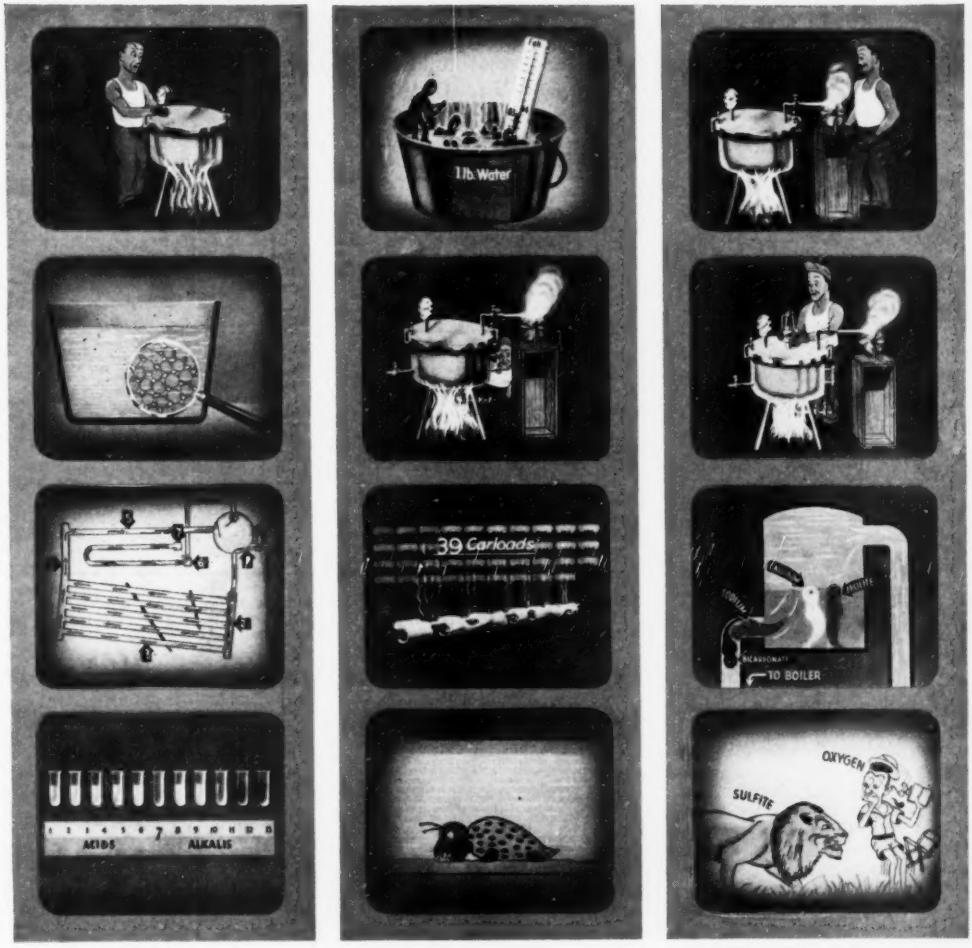

# Careful Planning Produces Training

**If your training program has bogged down or isn't producing results, give it a shot in the arm with new ideas. Here's how one company solved its problem by intensive planning and exacting follow-through**

► ARMSTRONG CORK CO has thrown out of the window the practice of letting new men "pick up" by just watching and listening to old-timers. "It may have worked when equipment was simple and fuel cost low," says A. W. Bassett, chief power engineer, "but with millions of dollars invested in power plants, where fuel bills themselves are enormous, we can no longer afford to take that kind of chance."

Of course, as in many other progressive companies, each plant has always been provided with operating procedures that give necessary information on such subjects as how to (1) prepare a boiler for service (2) fire with different fuels (3) handle turbines. But company executives, feeling this was not enough, decided to broaden the training policy to include their power plants and give all the men basic theory and practical on-the-job training by a fully qualified indi-

**...SEVERAL FILMS SHOW THE EASY-TO-GET STYLE OF PRESENTATION**




# Program That Clicks

By GENE FELLER, *Associate Editor*

vidual. No more of this catch-as-catch-can information passing!

**Educational Policy.** Management under the guidance of H. W. Prentis, Jr, president, a strong advocate of specialized training to fit the individual for his job, instituted a plan several years ago. Through it an employe, who has completed a study course along the line of his work, in night school or by correspondence instruction, is reimbursed for the cost. This applies also to college graduates studying for advanced degrees.

Unfortunately, educational facilities for formal training in power-plant work are not always available. And to be of maximum usefulness the training must include procedures and practices that cover special features peculiar to each plant. Knowing in advance the obstacles to be overcome, the answer is usually to assemble the material and prepare a course suitable to each plant's needs. Advantage of this procedure is that it can be arranged to present information in small doses easy to digest and absorb. The Armstrong course, as set up by Bassett, already mentioned, and T G Newton, training director, meets these qualifications in every detail.

**Other Users.** The course is good. How good is evidenced by the fact that other organizations, including Koppers Co, Wisconsin Public Service and

## STEPS TO FOLLOW IN TRAINING A MAN ON THE JOB

1. Explain why he is being taught the job.
2. Take him to the equipment. Describe it, tell what it does, and about its part in the production.
3. Identify the major parts of the equipment and explain their purpose.
4. Explain to him the use of this operation procedure.
5. You make a check run, reading from the operation procedure as the steps are completed. (He follows with his copy of the operation procedure.)
6. You make an actual run, reading from operation procedure. (He follows with his copy.)
7. Invite questions.
8. He makes a check run, referring to his operation procedure and explaining. Correct him when necessary. Have him repeat dry run if necessary.
9. He makes actual run without operation procedure, explaining steps as he goes. Correct him when necessary.
10. Review with him manufacturer's operating instructions and discuss drawings.
11. Throughout the training invite questions.
12. Check him at intervals, the frequency depending on progress he is making.

## PRINTED PROCEDURES GUIDE THE TRAINEE

ARMSTRONG CORK COMPANY — OPERATION PROCEDURE NO. 1
PLANT: Beaver Falls — DEPT. Power Plant 27th St. — Date: June 3, 1947
OPERATION: Ash Removal — SHEET NO. 1 OF 2 SHEETS
MAJOR EQUIPMENT: 6" United Neuveyor Ash System — FOREMAN: Earl Mc Collum

| STEP | WHAT IS TO BE DONE | HOW YOU ARE TO DO THIS AND WHY |
|---|---|---|
| | I. TO START CONVEYOR | |
| 1. | Make sure ash is dry | Dampen ashes on #1 boiler only. To keep dust down use water hose. |
| 2. | Make sure steam drains are open | Drains must be open at all times when the system is not in operation to prevent condensate from corroding the seats on motor operated valve |
| 5. | Ash stops moving, vacuum is lost, or capacity reduced. | a. Check for plug-ups in line.<br>b. Check for leaks in line.<br>c. Check for jammed swing gate.<br>d. Check for faulty exhauster nozzle. |

APPROVED BY:

Chief of Power Engineering — Date

Chief Engineer — Date

**PRELIMINARY PROCEDURES,** issued during the erection period, are checked for changes in plant layout and revised to fit the operation of equipment as installed

Wilson Packing Co. have secured it for their own use. The latter firm translated the text into Portuguese for their plant in Brazil.

**The Beginning.** In 1940, a policy was established that required the writing of operating procedures and training of operators on the use of each piece of power-plant equipment. The war soon interfered with the program and, except in the Lancaster, Pa. plant, little was done for several years.

The program as it exists today was created in 1947 as the result of a request, by E K McCall, plant engineer, then of the Beaver Falls, Pa. plant and now of the Camden, N. J. plant, that a complete power-house course be developed for the Beaver Falls plant. Once started, the idea snowballed until it was decided to go beyond the orignal scope and develop a base program that, with slight modifications, could be made to fit the needs of all company power plants.

**Organization.** With the general idea in mind, Bassett and Newton started things moving by calling a conference of all power-plant foremen, plant engineers, the engineering department heads, and the representative of their insurance carrier. When the meeting adjourned the groundwork was laid and a course of action charted to teach each operator (1) what he *must* know and (2) what he *should* know.

Next problem was to find a man capable of carrying out this job. Naturally he had to be a power-plant man who could not only write but also dream up ideas that would help put the points across. Bassett and Newton found the man they wanted in R G (Dick) Wickert, power-house foreman at the Lancaster floor plant. He had the know-how and he could write.

Working closely with Newton, Bassett and C C Simeral, asst chief power engineer, Dick designed a training system that covers all phases of their power-plant operations.

**Sound Slides.** To date Dick and his team have completed color sound-slide films on steam generation, feedwater treatment and operating rules for boilers. Each film is divided into several series of sequence steps, each series illustrating and driving home one particular point. Then the point is reviewed before proceeding to the next sequence.

Other subjects, such as valve construction, flue-gas analysis and steam accessories, are taught with large posters that carry cross-section drawings or sketches of the steps needed to explain the "insides" of a piece of equipment. Finally each student is given a 2-page folder of questions he must answer to prove his knowledge, or lack of it, of the subject.

**Subject Presentation.** To get an idea of how complete these slide films are let's take a look at "Steam Generation." First of all there is a hero named Pete. Now Pete is green at the game and being a fairly modern lad hasn't even had much experience with a tea kettle. So he starts out with an ordinary pan of water over an open flame to learn the ways of transferring heat from flame to water and how it induces circulation in the water.

After seeing how steam is formed Pete is told to put a lid on the pan. In this way he sees why the steam has to be penned up before it can be made to do work. Next comes a pressure gage so Pete can watch the pressure build up. Then he gets a simple explanation of pressure-temperature relations and learns what a Btu is and does.

With pressure built up, Pete is given a pinwheel to hold in front of a discharge line fitted to the pan lid so he can see why a turbine runs. Since

## LOG RECORD SHOWS TRAINEE'S PROGRESS

ARMSTRONG CORK COMPANY
Name _____
Fireman Helper 27th St.

TRAINING SCHEDULE

Beaver Falls
Power Plant
Date _____

| | | Operation Procedure | Training | | Grading | | Training Completed |
|---|---|---|---|---|---|---|---|
| | | | Sequence | Date | Operation | Rel. Material | |
| 1. | Introduction to Department | Induction Outline | 1st Day | | | | |
| 2. | Job Responsibilities | Job Description | 1st Day | | | | |
| 3. | Ash Removal | 1 | 1st Day | | | | |
| 11. | | | | | | | |

Grades: E-Excellent, S-Satisfactory, U-Unsatisfactory

I certify that _____ is thoroughly qualified for the position of Fireman Helper, having considered factors beyond operating knowledge, such as judgement, mechanical aptitude, willingness to cooperate, job interest, and dependability.

Date _____ Foreman, Power Plant

I have examined and observed the applicant and find him qualified for the position of Fireman Helper

Date _____ Power Section Engineering Department

**PERSONNEL RECORD** of each operator shows his progress up the line of training and whether he is qualified for advancement to the next higher course of instruction

this operation leads to low water in the kettle, Pete has to stop and install a feedwater line and gage glass, as well as add more fuel to the fire.

As additional water enters the boiler, Pete learns that minerals dissolved in the water accumulate and pile up on the bottom. He then gets busy and installs a blowdown line. Back in operation again, our recruit learns about a safety valve the hard way. But fortunately he lives to install one on his new boiler. Inspecting his turbine, as all good engineers do, our hero finds the blades of his pinwheel show wear.

Of course, he is let in on the difference between saturated and superheated steam, but this gets him more work. He has to install a pipe coil in the flame so the steam can be dried before it reaches the turbine.

From here, Pete gets a chance to compare his kettle with a regular boiler and learn how steam generation in a modern power house is a development of the simple facts he has just studied. He learns how (1) water circulates (2) steam and water separate (3) insulation cuts down heat loss (4) boilers differ in design. He also finds out why boilers need baffles, etc. Before Pete says good-by on the 73rd slide, every important point covered in the sequence is reviewed and emphasized.

**On-the-Job Training.** In addition to the films and posters, operating procedures are provided for every piece of power equipment in each plant. In fact, a preliminary procedure is issued on a new machine before it is installed so the men can study the instructions as erection progresses. After initial operation this procedure, revised if necessary, serves as a permanent guide.

The procedures are tools the powerhouse foreman uses to instruct and train new men by actual manipulation, as illustrated in the table. He accompanies the trainee, informs him how to follow the procedure and checks his every move until the new man proves he knows how things operate. It is the foreman's duty and responsibility to do the training personally. He is instructor of both the theoretical and practical courses with material furnished by Dick Wickert.

**How Program Works.** Suppose one of the branch plants decides to run the course, "Steam Generation." Wickert takes the sound-slide film on this subject together with a "Leader's Guide" to the power-plant foreman. The "Guide" contains such instructions as (1) how to handle a meeting (2) how to set up, adjust and operate the projector (3) what to tell the group before running the film. Wickert personally explains setup to the foreman.

After the film is shown a set of review questions is given to each student. He has 10 to 15 min in which to write his answers. This is followed by a presentation of each question to the group for open discussion.

Each man grades his own paper as the foreman explains the correct answers and shows the application in the particular power plant under discussion. At the end, the grades are collected and examined to determine whether it is advisable to reshow the film immediately or review it later.

**Follow-Through.** "Leader's Guide" contains the complete monologue text for each slide as it appears on the screen so the instructor can refer to it if a point is not clearly understood by an individual in the class. As a final check on the trainee's progress, the record above shows what courses he has completed and his standing.

Has the program paid off? Armstrong executives say outlay for the training courses has been repaid many times over in more efficient operation, additional suggestions for improvements, and better employe relations.

## Frozen Vent Causes Heater Explosion

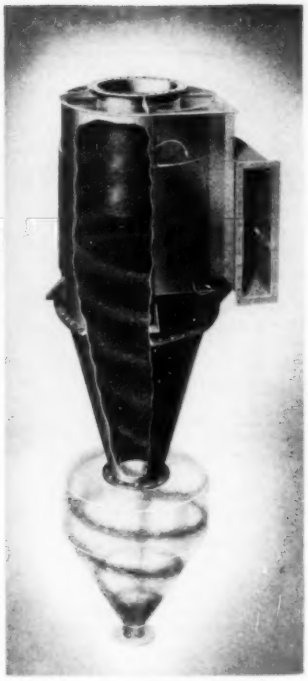
9A-338-41a—AN OPEN-TYPE FEEDWATER HEATER had a 3-in. vent that led from the top of the unit to the outside of the building, then down to ground level. At this point a 90-deg elbow in the line changed the course of the flow from vertical to horizontal. The pipe then led directly into a blow-pit.

There was no other relief on the heater and when moisture in the uninsulated pipe froze solid the pressure began to build up. The heater received condensate from milk-drying machines operating at 80 psi. While there is no way of knowing what pressure may have been in the heater when it exploded, there was enough to shatter the unit.

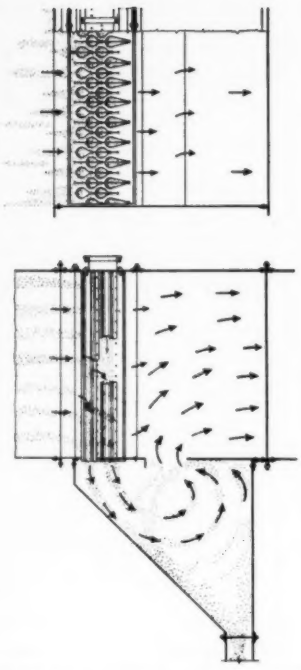
Roof of the building was raised by the explosion's force but equipment and machinery were spared. No one was in the building at the time of the accident.—*The Locomotive*

By L N ROWLEY
*Executive Editor*
*and*
J C McCABE
*Associate Editor*

**Even a well-run power plant can violate today's stricter smoke ordinances. But there are highly efficient devices on the market that will clean up your stack dusts to where they'll meet your code . . .**



**1** Cyclone dust collectors employ a familiar principle, are widely applied



**2** Cinder trap proves particularly well suited to removing larger particles

# Here Are the Working Tools for

► WHY DO EVEN the best-run plants frequently need dust collectors? Because some ash carryover is inevitable, and newer ordinances impose closer limits. How flue dust is produced, how it behaves, and how typical firing methods stack up against the limits in the ordinances were covered in August POWER, pp 76-78. That article also outlined the basic principles of collection. Here we're taking the next step—a closer look at commercially available devices, the tools at hand for dust collection.

Simple means for removing particles may be used in some cases. A so-called change-in-velocity separator consists merely of a wide space in the duct or breeching. This abrupt change in cross-sectional area produces a sudden change in velocity. The gas stream slows down and the heavier particles settle out. In the baffle separator, gas flows around a bend formed by baffling. Inertia makes the heavier particles tend to keep going in the old direction and throws them out of the stream.

More effective removal, particularly of finer particles, requires larger forces than these simple devices can produce. Thus commercial dust collectors feature a variety of designs intended to apply strong forces to the particles. Fig. 1 through 10 indicate typical constructions employed.

**Cinder Traps.** The cinder trap of Fig. 2 combines sudden reduction in velocity with sharp changes in direction. It finds widest use for collecting the relatively coarse particles coming off hand-fired and stoker-fired fuel beds.

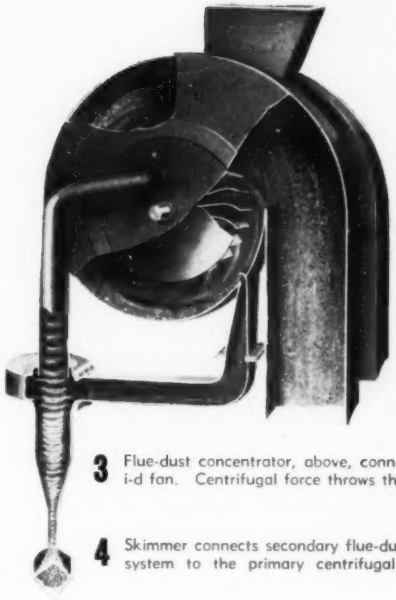
A battery of specially shaped slotted-steel elements stand vertically in the flue. They are arranged in staggered rows, Fig. 2, and assembled in sections four to ten elements wide.

Flue gas entering the cinder trap comes in contact with the slotted steel elements, and the gas stream changes its direction to get around them. Entrained cinder particles tend to continue on into the slot because these heavier particles do not change direction so readily. Once in the element, the particles fall down the vertical steel pieces to the collection hopper below. This system has no moving parts and a low draft loss—about 0.1 to 0.2 in.

**Centrifugal Removal.** For stronger action on dust particles, centrifugal force is put to work in a variety of ways. Gas flow must be speeded up and so induced-draft fans are pressed into service.

Fig. 3 and 4 are examples of one type of centrifugal dust collector. Fig. 3 is designed for draw-through operation. It is a flue-dust concentrator combined with an induced-draft fan.

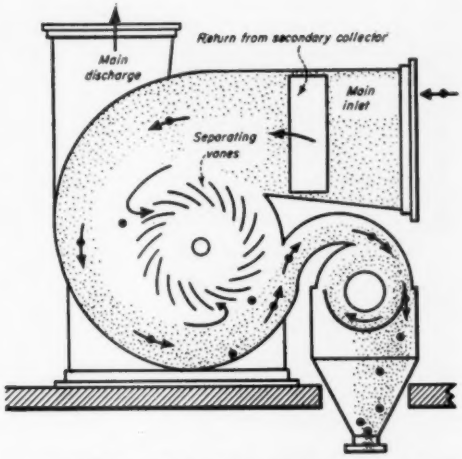
Usual arrangement consists of a double-inlet fan placed between two such collectors. Outlet sides of the collectors form the side sheets of the fan.

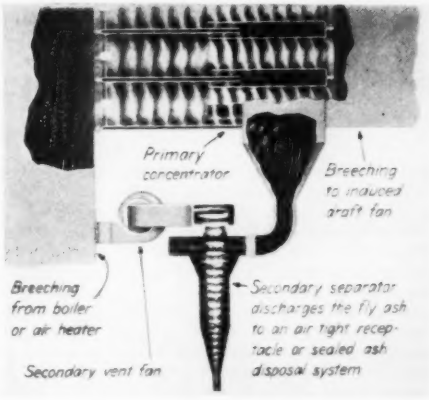


**3** Flue-dust concentrator, above, connects to an i-d fan. Centrifugal force throws the dust out

**4** Skimmer connects secondary flue-dust removal system to the primary centrifugal separator

**5** Spinner elements in double tubes force dust to outside; clean gas goes out tube in center





Primary concentrator
Breeching to induced draft fan
Breeching from boiler or air heater
Secondary separator discharges the fly ash to an air tight receptacle or sealed ash disposal system
Secondary vent fan

# Flue-Dust Collection

It is possible, though, to use a single-inlet fan connected by duct work to a collector outlet.

Dust-laden flue gas enters the primary volute at its largest diameter or at the outside of the scroll. Decreasing radius of the volute increases the centrifugal force working on the flue dust in the gas stream. This results in the dust being carried to the outside of the volute. Near the minimum radius point a tangential slot or take-off with a skimmer removes a small volume of highly concentrated dust-laden gas.

Because of the centrifugal force pulling the heavy dust particles to the outside, clean gas is at the center. It passes out through specially designed guide vanes that reduce turbulence and insure stable fan operation for changing load conditions.

The highly concentrated dust-laden gas discharged through the scroll of the primary volute by the skimmer, Fig. 3, shunts through a secondary system where flue dust is separated from the gas.

For the average installation the pressure built up in the primary collector is enough to give proper circulation in the secondary system. If required, a fan may be added.

The secondary collector is a modified cyclone design of centrifugal collector. This class will be described a little later.

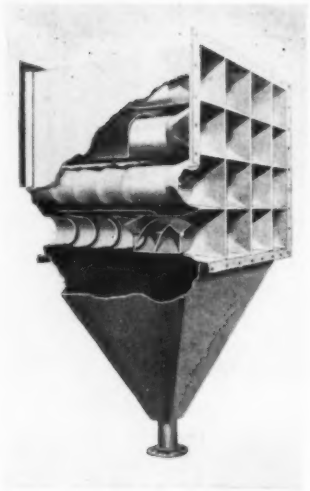
A second centrifugal-force design appears in Fig. 4. Again, usual arrangement is for centrifugal collectors to mount on either side of a double-inlet induced-draft fan.

Here gas enters fan inlet and travels to a specially designed spiral inlet box, located ahead of the fan rotor. Before the gas can enter the rotor, it must pass through reversing vanes. These vanes cause the gas to change its direction of flow.

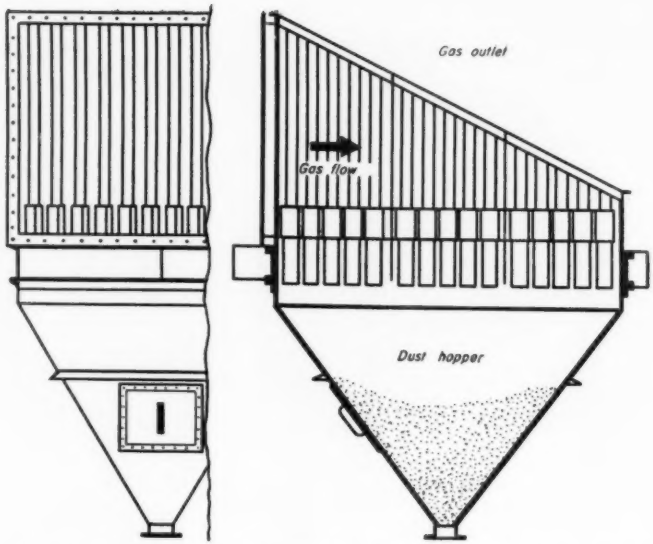
As the gas changes direction, momentum of flue-dust particles makes them fly off in a tangential direction and separate from the main gas stream. Clean, dust-free gas continues on through the rotor and up the stack. The flyash concentrates near the outside of the inlet scroll.

A portion of the gas carrying the concentrated dust draws through a shave-off into an auxiliary collector. This collector is a double horizontal one running the full width of the fan and flue-dust separating assembly. An inlet at each end receives the concentrated dust streams from the two centrifugal collectors or fan inlet boxes on each side of the induced-draft fan. An auxiliary fan pulls out the small stream of flue gas that acted as a carrier for the concentrated flue dust. This gas returns to the main fan inlet.

Removal of flue dust ahead of the fan rotor reduces wear on that rotor. If



**6** Inlet helicoid produces centrifugal force, cones skim the separated dust




**7** Group of 6- or 9-in. dia centrifugal tubes takes gas in tangentially through tube inlet slots, above, throws dust out at the bottom of straight tube, right

desired, the dust-separating vanes can be made adjustable so they can double as volume-horsepower controls.

**Tube Separation.** Still another means of centrifugal dust separation shows in Fig. 5 and 6. Here, Fig. 5, two tubes, one larger in diameter than the other, make up the primary dust-separating or concentrator elements. These tubes are arranged in a telescope fashion with the smaller tube reaching a short distance into the larger and centered in it by an annular orifice.

The larger tube serves as the inlet for flue gas. At this tube entrance is a metal spinner plate. Spinner action forces incoming flue gas to the outer rim of the tube. Resulting centrifugal force tends to concentrate any entrained flue dust around the tube wall.

The cleaner gas moves through the center of the tube and enters the smaller, or outlet tube. The smaller volume of flue gas carrying the now heavily concentrated flue dust continues on through the annular orifice. After it passes through the orifice the flue dust falls into the dust chamber surrounding the smaller tubes.

This flue dust and its carrier stream of gas from all the primary concentrator elements are drawn into a secondary, high-velocity dust collector. The secondary collecting system is a closed circuit, removing flyash from the carrier gas and returning clean gas to the primary outlet.

Under average installation conditions the individual tubes in the primary concentrator handle up to 450 cfm, requiring an approximate inlet area of 1.10 sq ft per 1000 cfm. Units may be assembled from 6 to 24 tubes wide or high. Where gas volumes are considerable 2-cell units are recommended with a double secondary dust-collector system.

Somewhat the same system of dust separation occurs in Fig. 6. Here the collecting element consists of a triple flight, oblique helicoid followed by a series of truncated cones.

These cones have chamfered edges so the leading edge fits well into the tube section in front of it. Minimum clearance is ¼ inch. The whirling action set up in the flue gas by the helicoid directs the flue dust toward the outside of the helicoid. As the gas continues through the truncated cones the outer layer of the vortex is progressively shaved off and separated from the main gas stream.

The intake is fitted with transition sections that lead the gas into the helicoid. At a maximum velocity of 2500 fpm, each element has a gas capacity of 1194 cfm with a reported draft loss of 1.65 in. of water. Each element requires 12 in. lateral and 11 in. vertical space. The standard elements are 81 in. in length.

**Cyclone Collectors.** The cyclone is a familiar tool, widely used as a separating device for removing solid particles from air or gas. The basic principle upon which it works is simple. Incoming gas is guided into a cylindrical tube in such a way, usually tangent to the cylinder, that a whirling action is set up within the chamber.

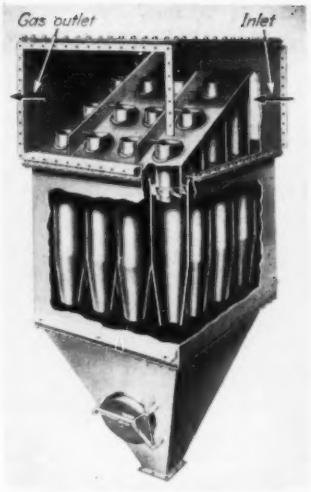
This whirling action generates a centrifugal force that attempts to throw any suspended particles toward the outside of the chamber. The force with which these particles are thrown out depends on how fast the gas is whirled and how sharp is the radius in which it moves. The relatively cleaner gas goes toward the center.

The whole operation sets up a vortex within the cyclone chamber. The clean gas is in the center zone where a strong updraft is created so it heads back up to the top of the cyclone. An outlet for the gas permits the clean gas to be constantly removed from one end of the cyclone and the now separated dust particles to be collected at the opposite end.

Fig. 1 is a cutaway section of a working cyclone. The flue gas enters at the right at a tangent to the cyclone chamber walls. It hugs the wall as the whirling action develops. After making several passes in the upper section it enters the lower conical section.

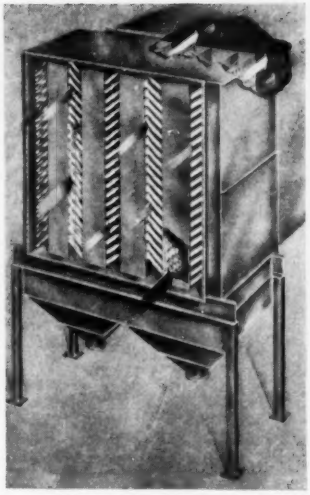
This section, because of its constantly smaller diameter, permits the gas and dust particles to build up velocity through their spiral, downward path. This action helps create a strong vortex to carry out the clean gas and separate the flue dust.

The cyclone design of Fig. 1 has an




**8** Cyclone assembly receives gas at the top, delivers dust to single hopper

**9** Small, 3-in. cast-aluminum tube has ramp inlets for incoming-gas stream



**10** Typical assembly, above, receives inlet gas at a right angle to tubes

additional port built into its upper casing. This port, called the shave-off, is located where eddy currents tend to deposit extra fine flue-dust particles. Instead of accumulating at this point they are led by the shave-off port down through a bypass duct to join the main body of dust at the lower conical section of the separator.

**Multiple Units.** Multicyclone collectors, as the name suggests, employ a group of cyclones operating in parallel. In such an arrangement, getting a uniform distribution of dust-laden flue gas to the individual cyclones proves important. Some depend on a split-duct manifold as a feeder device. At least one has inlet dampers for each unit interconnected with the others in parallel. As the load decreases the dampers narrow the inlets to each cyclone to compensate for the drop in gas velocities.

Theory indicates that one way of increasing the force with which particles are thrown out of a gas stream is by going to a sharper radius. Some multiple-cyclone units thus employ a larger number of smaller-diameter tubes.

In Fig 8 a special positioning vane at the top of 6- or 9-in. dia collecting tubes permits bringing the gas in at the top of the assembly and there setting up the necessary cyclonic action. Since the gas enters each tube through a number of entrances, formed by the space between the blades of the inlet vane, it is felt that distribution of the flue gas within the tube is more uniform.

The vortex built up in each tube develops an appreciable force. The dust thrown downward and outward emerges from the collecting tube with pressure enough so it could be discharged even if the tube were operated upside down. Once the dust is discharged it falls into a cone-shaped hopper designed so it cannot reenter the upward spiral of clean gas.

Fig. 7 consists of a group of centrifugal tube collectors, 6 to 9 in. dia, housing a smaller tube inside. Tube assembly is held between two parallel tube sheets. The individual tubes have long, narrow slots that act as inlets. Directional guides in the slots lead the gas into the tube chamber at a tangent.

For a 6-in. tube assembly a 4½-in. central tube projects well below the inlet. Annular space between outer and inner tubes measures only ¾ in. and serves as a guide channel for the incoming flue-gas stream until the cyclone action has been established. The inside of the central tube becomes a delivery duct for the clean gas traveling in the upward draft of the vortex.

The 6-in. collecting tube has no conical bottom. The reasoning is that the separated dust will be thrown tangentially off the bottom of the tube. The clean gas going up the center is kept by this action as far as possible from the dust-bearing outer whirl.

Fig. 9 and 10 picture the elements of a dust collector employing individual tubes only 3 in. in diameter. The idea of very small tubes grew out of wartime research on dust separators for close spaces. The tube is reported to give good results in removing dust particles in the range of 5 to 25 microns.

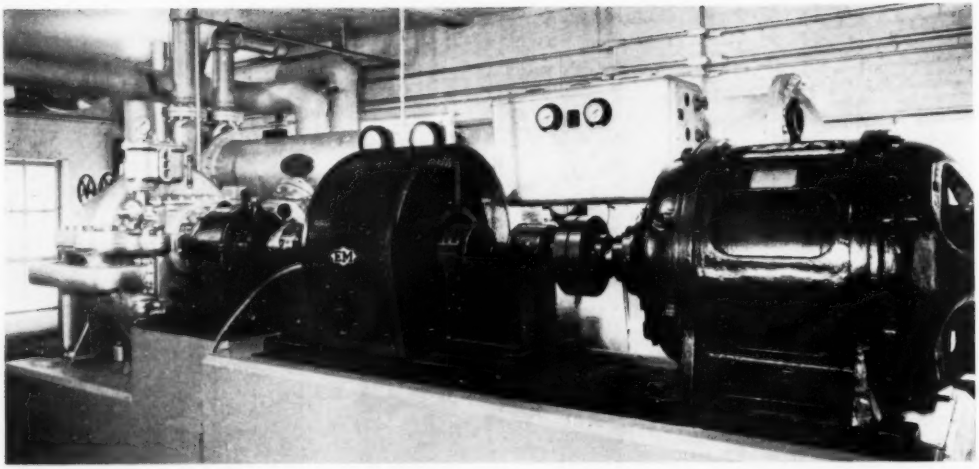
The basic element, Fig. 9, is a 3-in.-diameter cast aluminum-alloy tube. Individual tubes assemble, Fig. 10, into 60-tube "building blocks" arranged 4 tubes high by 15 wide. Each tube is set at 45 degrees in its tube sheets.

The stacks of units can then be assembled vertically or horizontally as the available space requires. The incoming flue gas passes over the rows of tubes and enters the so-called ramp inlets. The gas then experiences the familiar cyclone action, leaving its heavy dust particles to drop out the bottom of the larger section of the tube, Fig. 9, and the clean gas to continue out the opposite end.

Individual tube capacity varies with temperature and allowable draft loss through it. As an example, with a gas of 400 F and an allowable draft loss of 2.5 in. of water, each tube can handle 65.8 cfm.

Because of individual tube size and the resulting flexible physical arrangements the collector can be laid out for a side inlet and outlet, that is, straight through, or for side inlet, top outlet, top inlet and either side outlet.

*This is Part I of a 2-part article. Part II will appear in an early issue.*



**MAGNETIC DRIVE.** A 150-hp 1750-rpm squirrel-cage induction motor drives a centrifugal refrigeration compressor through an adjustable-speed magnetic drive. Automatic control of compressor speed adjusts the refrigeration capacity to needs

# Magnetic Drive Controls Textile Mill's Air Conditioning

**Electronic-controlled adjustable-speed drive between 150-hp squirrel-cage motor and refrigeration compressor on air-conditioning system holds spray water to 0.5 F of selected value**

BY RUSSEL RANSON, *District Manager*
*Charlotte, N. C., Electric Machinery Mfg Co*

► AIR CONDITIONING has made rapid strides in textile mills, particularly in the Southeast. There is a recent installation in Albemarle, N. C., in the knitting department of Wiscassett Mills Co. This plant, a division of Cannon Mills Co, knits ladies' fine-gage full-fashioned hose. An interesting feature of this air-conditioning system is the adjustable-speed drives on the refrigeration compressor.

**New Installation.** The new refrigeration installation was recently added to an existing evaporative cooling system serving a portion of the plant. The old system maintained constant relative humidity in the knitting departments, but gave no temperature control. The new system has equipment for close, automatic control of both temperature and humidity.

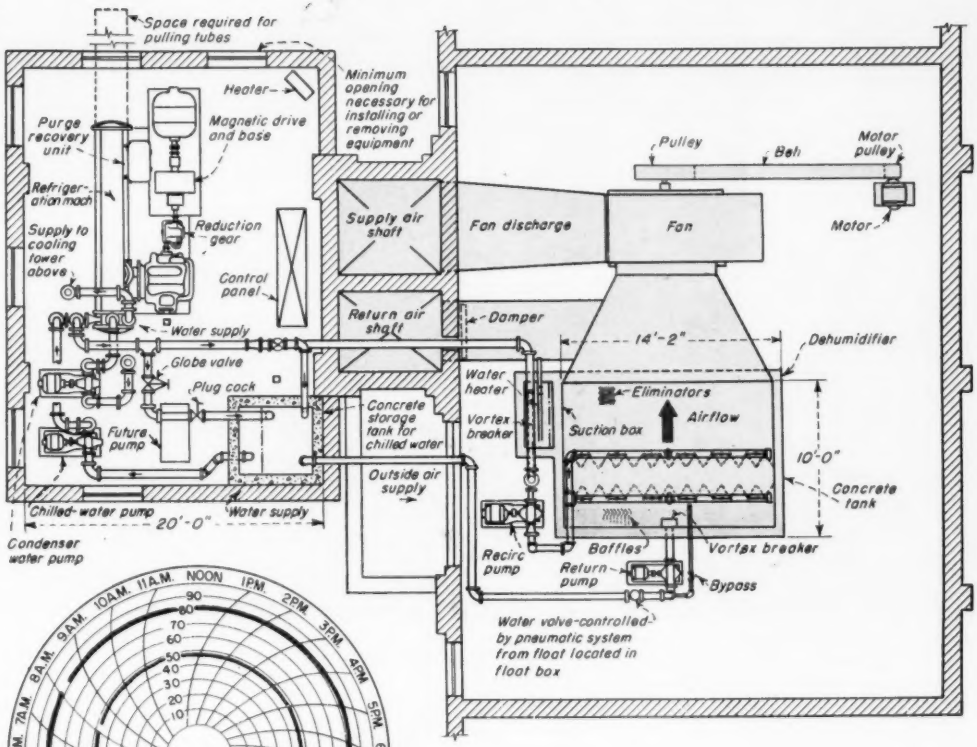
Drawing shows the equipment arrangement in refrigeration and spray rooms. Refrigeration machine cools the water supplied to the spray-type dehumidifier in the air-handling system serving the knitting rooms. During summer the main supply fan draws air from the knitting rooms through the spray-type dehumidifier, where chilled water is sprayed through it.

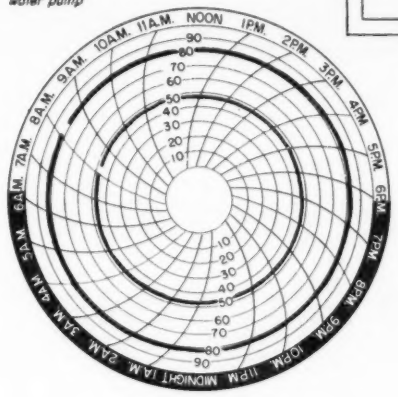
The spray removes heat from the air returning from the knitting rooms, and fixes its temperature. Cooling the air also condenses excess moisture not required for proper relative humidity needed in the knitting departments. After conditioning the air in the spray dehumidifier, the main air-supply fan forces it through the duct system to the knitting rooms.

**Temperature, Humidity.** Pneumatically operated, automatic controls in the conditioned areas position volume dampers and regulate steam coils in the duct room to iron out variations in humidity and temperature that may occur in the conditioned spaces. Temperature and humidity are thus maintained evenly day and night as desired by the plant management. At all times a small portion of air from the knitting rooms is dumped and replaced by outdoor air. This prevents the creation of a stale atmosphere within the spaces conditioned.

As the photo shows, the compressor is driven by a 150-hp 1750-rpm 440-v squirrel-cage induction motor. An Electric Machinery 150-hp adjustable-speed magnetic drive connects the motor to the Carrier refrigeration compressor. The magnetic drive has a speed range of 1735 to 353 rpm. Automatic control of the compressor's speed permits adjusting refrigeration capacity according to outside weather conditions as well as knitting-room needs.

The magnetic drive is an adjustable speed method that has been applied widely for speed control of boiler draft




**REFRIGERATION PLANT.** *Above:* Refrigeration and spray dehumidifier equipment room, Wiscassett knitting mills. Refrigeration machine sprays chilled water into dehumidifier to control temperature, humidity of ventilating air for air-conditioning

**TEMPERATURE CHART.** *Left:* Spray-water temperature is held at 48 F, room temperature at 82 F during 24-hr operating period

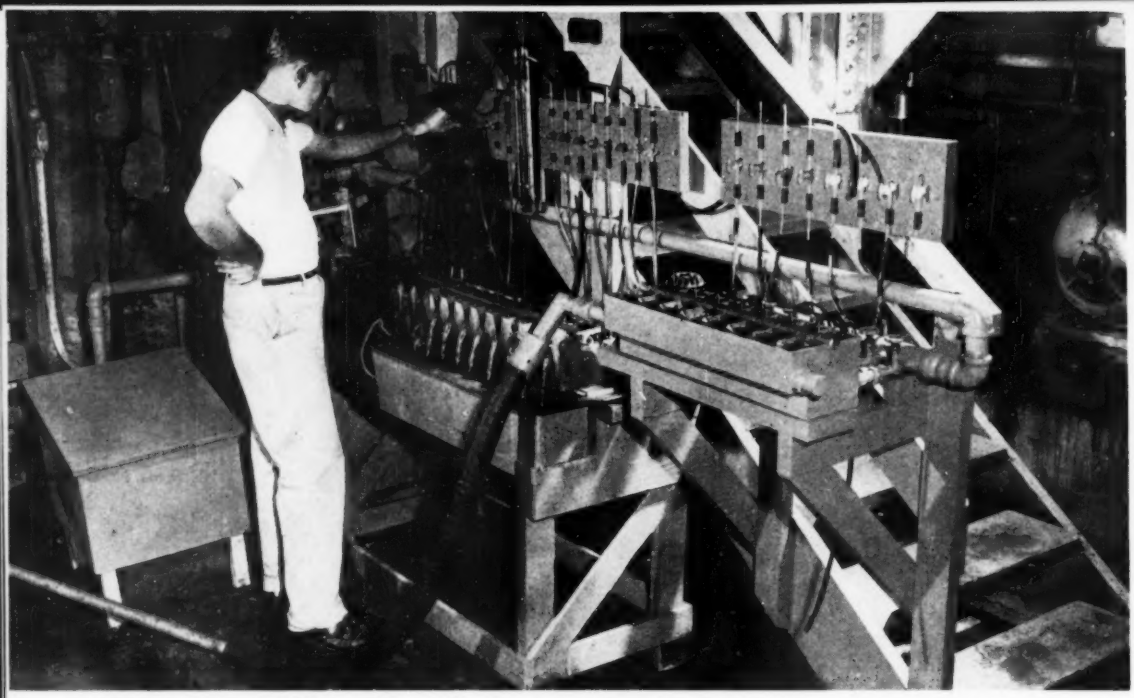
fans in central stations and industrial steam plants. Load characteristics of centrifugal compressors are similar to those of fans, and so the magnetic drive is equally favorable for centrifugal compressor operation. A characteristic of both these applications is that the load torque varies as the square of the speed. By varying the excitation in the field coils, transmitted torque and, consequently, the output speed are accurately controlled.

**Speed Adjustment.** Smooth, stable-speed adjustment is obtained by an electronic control, which acts as an automatic watchman between the magnetic drive and the compressor. When a temperature change is called for the automatic-temperature device operates through the electronic control to change the magnetic drive's output speed to that needed for correct temperature.

Results at Wiscassett Mills show that temperature can be controlled quickly. Water temperature for washing the circulating air is held within 0.5 deg F of selected value. Performance is stable, because there is no hunting or variation from the desired temperature, as the typical temperature chart indicates. The magnetic drive thus provides a practical way for meeting exacting requirements for accurate temperature control in textile mills.

When planning the refrigeration installation it was expected that at some future date the looping and seaming departments would also be air conditioned. Accordingly, the initial refrigeration-plant design provides for it. This installation went into operation using refrigeration capacity previously installed. This is done by supplying chilled water from the refrigeration machine to a new air-handling system serving the looping and seaming departments.

Reports on recent controlled atmospheric installations in textile mills show they give (1) more favorable working conditions in hot weather and reduced absenteeism (2) less maintenance of machines because of reduced rusting from sweat and a reduction in broken needles (3) increased production of first-quality goods because yarn runs better under conditions of controlled humidity and temperature (4) less spoilage of products because of the clean washed air.



**ASPIRATOR-TYPE JET-TESTING** equipment at Kure Beach, corrosion-testing station of International Nickel Co and Dow Chemical Co, measures effect of sea-water impingement on condenser tubes. Air bubbles are mixed with salt-water jets

# Iron Changes Corrosion Resistance Of Copper-Nickel-Iron Alloy Tubes

**Here is the how and why of condenser-tube behavior in regard to pitting, corrosion and impingement. Alloy makeup determines suitability of tubes for use with certain water conditions. Sometimes a compromise must be made among properties**

By **W LYNES**, *Supervisor Corrosion Section, Research Dept, Revere Copper and Brass Inc*

► MOST IMPORTANT DEVELOPMENT in steam-condenser-tube alloys during the past ten years was made by the British Non-Ferrous Metals Research Assn. They found that the addition of a small percentage of iron to cupronickel-30% causes substantial improvement in its resistance to impingement attack. Such attack is the erosion of protective scale by the impingement of water, particularly when air bubbles are present. It occurs in the presence of an excessive amount of entangled air and with high water speeds. It results in severe local attack.

Extensive testing in both England and the U. S. has shown impingement resistance in sea water of cupronickel-30% increases rapidly with additions of iron up to about 0.3%. Larger amounts result in comparatively minor improvement.

Some people have mistakenly assumed that the only function of iron in cupronickel is to improve impingement resistance by producing a more erosion-resistant corrosion product. Several types of corrosion may occur, however, by altering proportions of either minor or major constituents. Cupronickel condenser tubes are subject to attack by impingement, pitting and thinning. A change in the alloy does not usually affect resistance to all types of attack to the same extent, or even in the same direction.

Excellent corrosion resistance of cupronickel-30% in sea water is not due to the electrical potential of the bare alloy surface, but to the substantially higher potential of oxygen-containing surface-conversion products formed during initial corrosion of the alloy in its

environment as of the formation period.

As a matter of fact, in the electromotive series, *bare* cupronickel-30% is somewhat less "noble" than *bare* copper. A metal is noble when it is practically immune to attack by corrosive environments. Metals like gold and platinum are immune in practically all environments and are accordingly referred to as noble metals. Other metals and alloys vary in immunity from one environment to another. When they exhibit noble characteristics we say they are "passive." On the other hand, when they are attacked, their surfaces are referred to as "active."

In the electromotive series, nickel is less noble than copper by 0.57 v, iron less noble by 0.77 v, chromium by 0.96 v, and aluminum by 2.03 v.

An alloy of iron, chromium and nickel (stainless steel) will have a much higher potential than copper when its surface is passive. When active it will have substantially the potential of iron. An alloy of copper, nickel and iron (cupronickel) will have a high passive potential. But when active the potential will drop to about that of copper.

Some evironments permit both active and passive areas to exist side by side. These will be described, but for the moment it is important to realize that the greater the potential difference between an active and a passive surface (for the same ratio of active and passive areas) the higher the corrosion rate at the active, or anodic, surface of the material.

Maintaining the passive state usually depends on a continuous ample supply of *dissolved* oxygen over the entire metal surface exposed to the environment. In general, the larger the capacity of the alloy for passivity, the larger the oxygen requirements for optimum corrosion resistance. Other things being equal, the more passive the alloy under optimum conditions of oxygen supply, the more severely will it pit at points of local oxygen deficiency because of the higher potential developed between oxygen-rich and oxygen-poor areas. Likewise, if oxygen is *everywhere* deficient, the more passive the alloy, the more rapidly will it corrode completely, relative to the passive state.

Another way of stating the influence of the passivity of a condenser-tube alloy on its performance follows: the greater its inherent passivity, the better its corrosion resistance under operating conditions favorable to maintenance of its passivity. But the fewer are the operating conditions where optimum passivity can be maintained, and the more rapid its failure under locally active conditions.

As the iron content of cupronickel-30% increases, its potential (passivity) in sea water containing dissolved oxygen increases. As a practical consequence the alloy has a decreasing tendency to thin generally and an increasing tendency to pit locally. In view of this the iron content should be kept below that which would produce a dangerous pitting tendency. The ideal amount results in a balanced tendency toward thinning and pitting so neither will occur to excess.

There are insufficient data for choosing a figure with any certainty. Amount of iron for optimum pitting-thinning resistance is less, however, than the amount for optimum impingement resistance. A reasonable compromise appears to be within the range of 0.25 to 0.5% iron. It should be understood that for some operating conditions iron-free cupronickel-30% might be desirable, and for others iron content larger than 0.25 to 0.5% would be desirable. The range suggested, however, is considered suitable for the majority of cases.

### CAUSES OF PITTING

Usual cause of pitting of cupronickel condenser tubes is oxygen concentration cells. These corrosion cells exist where portions of the tube surface are screened from sufficient access to the dissolved oxygen in the water. These screened surfaces become anodic to those receiving a more ample supply of oxygen. Such a condition is favored by shells and debris becoming lodged in the tube, by porous scale on the metal surface, and by other causes.

In pure sea water, the rate of oxygen-concentration-cell pitting in properly alloyed cupronickel shows a strong tendency to decrease with prolongation of exposure. Also, the pits tend to widen rather than deepen.

In polluted coastal waters the situation is much more critical. Here, the dissolved oxygen is usually low because of bacterial decomposition of organic and inorganic compounds. Bacterially formed corrosives such as hydrogen sulphide and carbon dioxide are present to greater or lesser degree. It is in such waters that sensitivity of cupronickel to iron content is evident, and where the merit of cupronickel in comparison with other condenser-tube alloys is in question.

Passivity of cupronickel increases with increasing iron content. It likewise increases with increasing nickel content. From this it is apparent that, within limits, when nickel is reduced, equivalent passivity may be obtained by a suitable increase in iron. Furthermore, with reduced nickel, iron assumes a more dominant role in the production of erosion-resistant corrosion products.

### QUANTITATIVE RESULTS

In impingement testing of the copper-nickel-iron alloys at the 10% nickel level, impingement resistance increases rapidly with increase of iron up to about 0.75% instead of 0.3% as with the alloy containing 30% nickel.

Pitting tendency in the 10% nickel alloy also increases with increase in iron content. But substantially larger amounts of iron may be tolerated than in the 30% nickel alloy. On the basis of today's experience it appears that iron may be present up to about 2% without likelihood of inducing a damaging tendency to pit.

It is for these reasons that the low-nickel high-iron cupronickels, such as 10% nickel, 1½% iron, possess properties similar to the standard 70-30 cupronickel. The particular appeal and promise of the low-nickel high-iron alloys is that they are less costly than 70-30 cupronickel, yet possess comparable properties under certain conditions.

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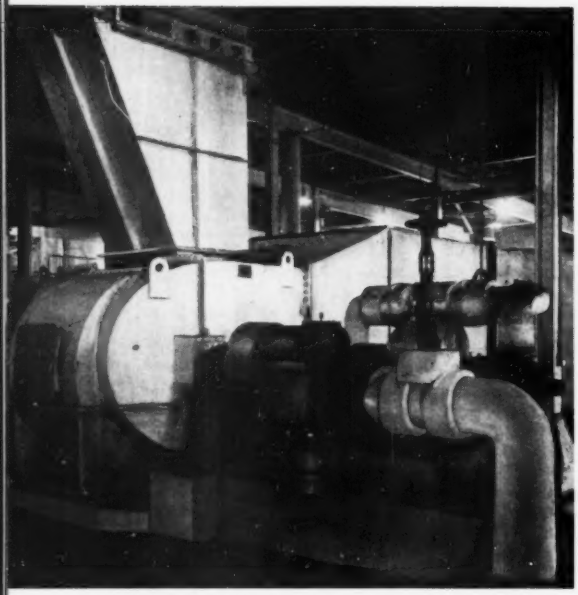
## British Enlarge Power Plants

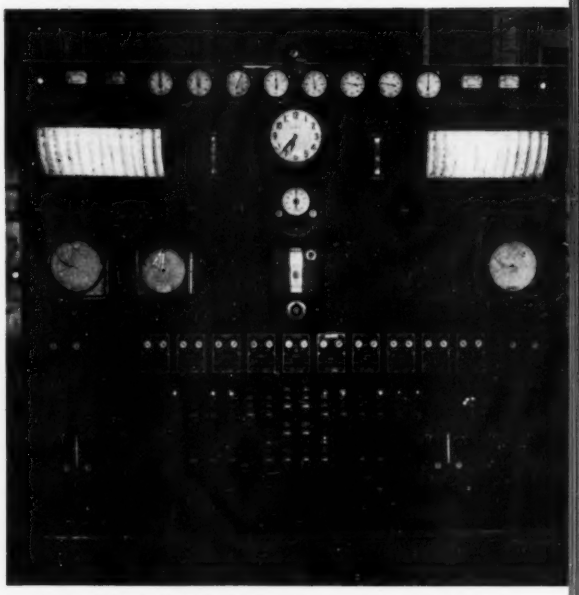
► BECAUSE OF MISINTERPRETING an original manuscript, POWER in its January 1949 issue stated that Hams Hall near Birmingham, England, with 300,000 kw ultimately, would be the largest station in that country. The British Electricity Authority have since pointed out this error. In their London Division they have three stations already at 300,000-kw capacity and over: Barking—522,000 kw, Battersea—345,000 kw, and Fulham—300,000 kw.

When extensions are completed these stations will have total capacities as follows: Barking—747,000 kw, Battersea—510,000 kw, and Fulham—360,000 kw.

These compare with the largest steam-electric plant in the world, Hudson-Gold of the Consolidated Edison Co of New York, which has a present nameplate rating of 881,000 kw. An extension under way, a 65,000-kw topping unit, raises this to 946,000 kw.



**1** **EACH BOILER** has induced-draft fan, rated 76,500 cfm at 8.5 in. wg, driven by a 150-hp turbine through gearing



**2** **METER AND CONTROL PANEL** for the wood-refuse boilers and coal-fired unit includes automatic combustion control

# Waste Fuels Produce About 90%

**Close attention to equipment selection and arrangement makes possible generation of nearly all steam for process and heat by burning black liquor and waste wood. Boiler plant has a maximum demand of 304,000 lb per hr in three 175-psi units**

By **K M SEGALOWITZ**, *Steam Power Engineer*
*Stadler, Hurter & Co, Consulting Engineer, Montreal*

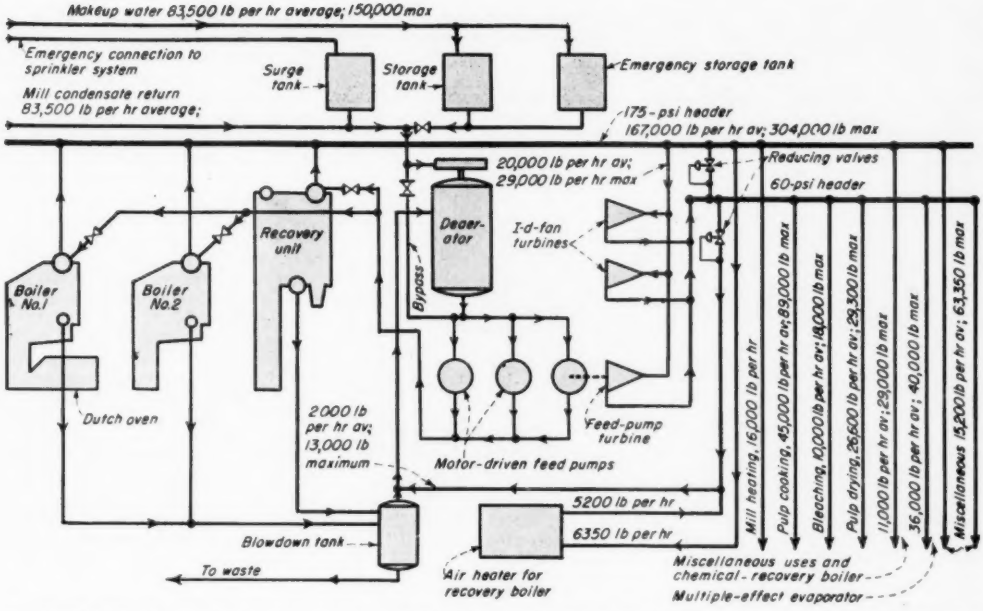
► PULP AND PAPER PRODUCTION requires large quantities of medium- and low-pressure steam for wood cooking, paper drying, heating and other purposes. Where coal or fuel-oil costs are high, as at most Canadian mills, steam production from wood wastes and the chemical-recovery system has high economic importance. The new boiler plant of Long Lac Pulp & Paper Co, a subsidiary of Kimberly Clark Corp, is a good example of byproduct steam generation in a modern pulp mill.

This 300-ton kraft pulp mill is on the north shore of Lake Superior at Terrace, Ont. We started design work at our offices in January 1946. Field construction began June 1947 and the plant went into full operation in the late fall of 1948. In the design and construction programs the boiler house was given priority so one steam-generating unit would be ready for operation during winter construction of 1947-48. Erection of the first boiler began in September 1947. Before the year's end it was ready for operation.

**Plant Design.** As is normal in process industries, the steam-plant design had to take into account those features peculiar to the industry and plant. Here, the four most important were:

1. Amount of wood refuse available for steam generation was large.
2. Chemical-recovery system could generate large quantities of steam.
3. Plant had to be laid out to reduce to a minimum costly steam mains.
4. Equipment had to be selected to suit the mill heat balance and steam-pressure requirements.

1. Wood refuse from the mill includes bark, cullwood, shavings, ends, sawdust, knots and other material, but mainly bark. This is separated from logs in barking drums with the help of showers. It is then collected by conveyors and, in this condition, contains roughly 80% moisture. Preparatory to burning, the bark passes through Nekoosa presses, which reduce the moisture content to about 60%. This figure generally applies to the refuse as a whole. The wood-preparation department operates three 8-hour shifts per day, and from 18,000 to 22,000 lb per hr of refuse is delivered to the boiler house. This


Makeup water 83,500 lb per hr average; 150,000 max
Emergency connection to sprinkler system
Mill condensate return 83,500 lb per hr average;
Surge tank
Storage tank
Emergency storage tank
175-psi header
167,000 lb per hr av; 304,000 lb max
20,000 lb per hr av; 29,000 lb per hr max
Reducing valves
60-psi header
Deaerator
I-d-fan turbines
Recovery unit
Bypass
Boiler No.1
Boiler No.2
Dutch oven
2000 lb per hr av; 13,000 lb maximum
Feed-pump turbine
Motor-driven feed pumps
5200 lb per hr
6350 lb per hr
Blowdown tank
To waste
Air heater for recovery boiler
Mill heating, 16,000 lb per hr
Pulp cooking, 45,000 lb per hr av; 89,000 lb max
Bleaching, 10,000 lb per hr av; 18,000 lb max
Pulp drying, 26,600 lb per hr av; 29,300 lb max
11,000 lb per hr av; 29,000 lb max
36,000 lb per hr av; 40,000 lb max
Miscellaneous 15,200 lb per hr av; 63,350 lb max
Miscellaneous uses and chemical-recovery boiler
Multiple-effect evaporator

**3 FLOW DIAGRAM.** While the steam pressures required in the processes vary from 10 psig in some heat exchangers to 175 psig in the digester-building header, it was found economical to bulk the steam for all services in a 60- and a 175-psig header

# Of Pulp Mill's Steam Needs

amount varies with the time of year, depending on the kind of wood and whether delivered at the mill by rail or water.

The wood room and drum barkers operate about 22 hours per day so there is about the same hourly quantity of bark going to the bark-burning furnace each day. During the barking season of 5½ months, about one half of the wood goes through the barkers and to the mill while the other half goes to the wood yard with bark on. During winter, rough wood goes through drum barkers from storage. No storage for refuse was provided in the original design, and all equipment is sized to handle the refuse as delivered.

With properly designed equipment and good operation, it is possible to generate at least 2 lb of steam per lb of refuse containing 60% moisture. Therefore, this quantity of steam justifies careful thought in the plant's design as it will repay a considerable part of the cost of refuse-burning equipment.

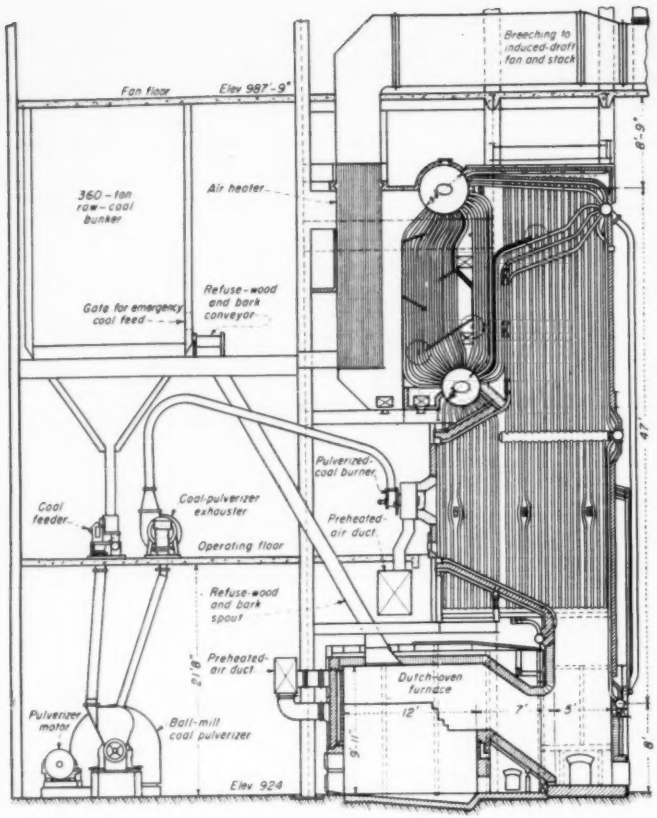
2. The chemical-recovery system in a kraft mill is worthy of a study in itself, so we plan to report on it in a separate article. For those unfamiliar with the kraft-pulp process, black liquor is spent digester cooking liquor, separated from the pulp in the washing process. It contains valuable sodium salts as well as the dissolved lignin portion of the wood chips. As obtained from the washing process, this liquor has only about 13% solids and must be concentrated before being burned in the recovery furnace. This is done first in multiple-effect evaporators where liquor density is increased to 50% solids. The liquor then passes through the cascade evaporator in which flue gas from the recovery boiler passes over and through the liquor. The latter's density is increased to about 70% solids and is then mixed with salt cake and pumped to spray nozzles in the boiler's furnace walls.

In the furnace, solids are reduced to a smelt and drawn off for further chemical treatment, while the heat thus liberated generates steam. Actual recovery of chemicals is of equal importance with the steam generation and often the former must be favored over the latter to ensure continuous service. In addition, operation of a recovery boiler is subject to interruption from causes originating in the process itself. Consequently, the rest of the steam-generating equipment should be sized to meet all steam demands if recovery boiler output is reduced.

3. Economy in layout of steam mains was obtained by grouping the digesters and multiple-effect evaporators next to the boiler house.

4. Equipment must have proper capacity and pressures. Flow diagram, Fig. 3, shows steam distribution to the different departments and boiler-house uses. Heaviest steam users are the digesters, pulp driers and chemical-recovery system. While the steam pressures required vary from 10 psig for some heat exchangers to 175 psig in the digester-building header, it was found most feasible to bulk all requirements into two steam headers, at 175 psig and 60 psig nominally. In addition, a separate header was run for mill heating.

**Steam Requirements.** As the diagram shows, average steam demand of 167,000 lb per hr is slightly over half the maximum demand of 304,000 lb per hr. Dur-




**4** **FUEL-BURNING BOILER.** Cross section through one of two pulverized-coal-fired units with its wood-refuse-burning dutch oven, designed to use preheated air

ing normal operation, 124,000 lb per hr is expected from the recovery unit. For a good part of the year, when the quantity of refuse is high, remainder of steam required for normal operations will be supplied from burning refuse. Consequently, burning costly auxiliary fuel like coal will be required to supply only small steam deficits.

To allow for all contingencies, however, the boilers were selected for a maximum of 85,000 lb per hr each, or a total of 170,000 lb per hr with pulverized-fuel firing, to satisfy the average mill requirements. Oil burners may be installed in the recovery unit's furnace to generate necessary additional steam should black-liquor flow fail. In addition, the pulverized-fuel boilers can operate at considerably above 85,000 lb per hr during emergencies. They are designed for 86.5% efficiency at 60,000 lb per hr, and are expected to have 85% at 85,000 lb per hr.

All the boiler-house auxiliary turbine drives operate in 175-psig steam and exhaust at 60 psig into the low-pressure mill header. For further economy, flash steam from the blowoff tank is fed into the deaerator.

**Equipment Design, Layout.** Fig. 4 is a cross section through one of two pulverized-coal-fired boilers with its refuse-burning dutch oven. Design of these units was based on similar ones, which have given satisfactory service in the Niagara, Wis., mill of the parent company. There are two burners, fired by pulverized fuel, which is the normal method of firing. As an alternative, steam-atomized oil burners are available for insertion inside the coal burners.

Below the main furnace is the dutch oven for refuse burning. It has 144 sq ft of grate area, divided into three 4x12-ft cells with division walls between them. Each cell is fired through an opening in its roof, in which is installed a swinging damper actuated by a hydraulic piston. This arrangement permits the operator to spread the bark over the grates as combustion conditions require. The dutch oven uses both underfire and overfire air, preheated to 310 F, and is regulated by remote hand control.

Pulverized-fuel firing is by either hand or automatic control. When on automatic control, burner secondary air-supply is changed by a steam pressure controller. The pulverized-coal and primary-air mixture is regulated through a ratio controller to maintain maximum furnace efficiency.

Gases from wood burning have a particularly long travel before mixing with the coal gases. Only one unit has a dutch oven, but one can be installed on the second boiler if required by future mill operations.

**Boilers and Air Heaters.** Steam drums are 54 in. in diameter, by 16 ft 6 in. long between welds. There are no superheaters or economizers. The air heaters are of tubular design. Forced-draft fans have inlet-vane control, and are motor driven. Induced-draft fans are speed controlled by turbine drives, and have outlet louver dampers.

On the recovery unit the induced-draft fan is motor driven through a hydraulic coupling by a 500-hp motor. Combustion air is preheated to 300 F in a steam-coil heater. Oil burners may be installed above the black-liquor burners either to help the liquor combustion along, or to generate steam when no liquor is available. On this unit soot blowers are air operated, and air lancing is also required to keep the tubes clean.

For operating purposes, the boiler house and recovery room have a common operating floor as well as a common feedwater system, blowoff tank and steam header. All three units are under the supervision of one superintendent. The recovery units, instruments and control are, however, separate from the boiler instruments and control.

**Feedwater.** During normal operation, makeup feedwater is 50% but can go as high as 90%. Makeup water and mill condensate returns are fed to the deaerator, which operates at 5 psig. Deaerator of the tray type has 10-min storage capacity, also a loop seal and relief valve. Of the three feedwater pumps, two are motor driven for normal operation, and one turbine driven for emergency. From the pumps the water goes directly to the boilers.

Wood refuse delivered to the boiler house by belt conveyor is transferred to a flight conveyor alongside the coal bunker. This conveyor has gates to feed the three chutes leading to the three cells of the dutch oven, rate of

## PRINCIPAL BOILER-PLANT EQUIPMENT

### Long Lac Pulp & Paper Co, Terrace, Ontario, Canada

**Steam-Generation:**

Boilers, waterwalls, air heaters — Foster Wheeler, Ltd
Boilers, two, 2-drum, heating surface 7189 sq ft, waterwalls, 5254 sq ft; air heater, tubular, 9540 sq ft; maximum gas temp—in, 594 F; out, 382 F; max air temp—out, 483 F. Max continuous steaming capacity 85,000 lb per hr; design steam conditions; 250 psig saturated; operating conditions, 175 psig. Furnace, dry bottom, volume 5580 cu ft, Btu release per cu ft per hr 18,100

Chemical-recovery boiler — Combustion Engineering Corp, Ltd
Recovering capacity 40,000 lb of dust per hr; max continuous steaming capacity 137,000 lb per hr; design steam condition, 250 psig saturated; operating condition, 175 psig

Steam-heated air heater — Combustion Engineering Corp, Ltd
Steam pressure 175 psig; air temp, out 300 F

Cascade evaporator, motor driven — Combustion Engineering Corp, Ltd

Cascade-evaporator motor — Canadian General Electric Co
Drip proof, 50 hp, 1150 rpm, squirrel cage

Motor starter, pushbutton — Canadian Cutler-Hammer, Ltd

Electrostatic precipitator, Cottrell — Precipitation Co of Canada, Ltd

Boiler refractories — A P Green Fire Brick Co

Boiler heat insulation — Norman A Smith Co

Stack and boiler breechings — Dominion Bridge Co, Ltd
Self supporting, 120 ft high, 12 ft inside diameter

**Combustion:**

Automatic combustion control — Bailey Meter Co, Ltd

Soot blowers — Diamond Power Specialty Co; F S B Heward Co, Ltd

Dutch-oven furnace — Furnace Economy Co
Preheated-air design, divided by longitudinal walls to form three independently fired cells, furnace volume 1743 cu ft, grate area 144 sq ft

Suspended-roof tile — Furnace Economy Co

Swing dampers, hydraulically operated — Neenan Foundry Co

Ash gates — Foster Wheeler, Ltd

Pulverized-coal equipment — Foster Wheeler, Ltd
Two burners, feeders, exhausters and a ball mill per boiler, 8500 lb per hr

Ball-mill motor — Canadian General Electric Co, Ltd
Splash proof, 125 hp, 900 rpm, 550 v, squirrel cage

Motor starter, pushbutton — Canadian Cutler-Hammer, Ltd

Exhauster motor — Canadian General Electric Co, Ltd
Totally enclosed 20 hp, 900 rpm, 550 v, squirrel cage

Motor starter, pushbutton — Canadian Cutler-Hammer, Ltd

Forced-draft fans — Canadian Sirocco Co, Ltd
Two, motor driven, 38,800 cfm at 10.5 in. wg and 100 F

Forced-draft-fan motors — Canadian General Electric Co, Ltd
Splash proof, 100 hp, 1750 rpm, squirrel cage

Motor starters, pushbutton — Canadian Cutler-Hammer, Ltd
One, motor driven, 75,000 cfm at 10 in. wg and 100 F

Forced-draft-fan motor — Canadian General Electric Co, Ltd
Splash proof, 150 hp, 1150 rpm, squirrel cage

Motor starters, pushbutton — Canadian Cutler-Hammer, Ltd

Induced-draft fans — Canadian Sirocco Co, Ltd
Two, turbine driven, 76,500 cfm, 8.5 in. wg at 450 F

Steam turbines, Moore — McRae Engineering, Ltd
Two, 150 hp, 4500 rpm, steam conditions 175 psig saturated, backpressure 60 psig; one motor driven through hydraulic coupling, 150,000 cfm at 10 in. wg and 300 F

Induced-draft-fan motor — Canadian General Electric Co, Ltd
Splash proof, 500 hp, 900 rpm, 550 v, squirrel cage

Motor starter, pushbutton — Canadian Cutler-Hammer, Ltd

Hydraulic coupling, variable speed — Canadian Sirocco Co

**Coal and Ash Handling:**

Coal bunker, 360 tons — Canadian Bridge Co, Ltd

Bucket elevator, tons per hr, 50 — Link-Belt Co

Flight conveyor — Link-Belt Co

Refuse flight conveyor — Link-Belt Co

Ash conveyors, Nuveyor — United Conveyor Corp

**Valves, Piping and Traps:**

Safety valves, Consolidated — Manning, Maxwell & Moore, Inc

Nonreturn valves — Crane, Ltd

Blowdown valve — Yarnall-Waring Co

Drain valves — Crane, Ltd

Steam-line gate valves — Crane, Ltd

Steam-line globe valves — Crane, Ltd

Pressure-reducing valves — Fisher Governor Co

Feedwater valves — Swartwout Co

Pipe fabricator — Crane, Ltd

Pipe heat insulation — Canadian Johns-Manville Co, Ltd

Traps and strainer — Armstrong Machine Works; Crane Co; Grinnell Co

**Feedwater System:**

Feedwater chemical pumps — Milton Roy Pumps

Feedwater heater, Cochrane — Canadian Allis Chalmers, Ltd
Deaerating, 400,000 lb per hr from 65 to 220 F

Feedwater storage tanks — Horton Steel Works, Ltd

Feedwater regulators, Swartwout — Dominion Flow Meter Co

Water columns — Yarnell-Waring Co

Feed pumps, three — Canada Pumps, Ltd
Two motor, one turbine driven, 4 stage, 300 gpm, 330 psi, 3500 rpm

Feed-pump turbine, Moore — McRae Engineering, Ltd
One, 90 hp, steam conditions 175 psig, 60 psig backpressure

Feed pump motors — Canadian General Electric Co
Splash proof, 100 hp, 3500 rpm, 550 v squirrel cage

Motor starters, pushbutton — Canadian Cutler-Hammer, Ltd

**Meters:**

Control panels — Bailey Meter Co, Ltd

Multipoint draft gages — Bailey Meter Co, Ltd

Steam-flow meters — Bailey Meter Co, Ltd

$CO_2$ recorders — Hays Corp

Steam-pressure gages — Crosby Steam Gage & Valve Co

Air compressors, motor driven — Canadian Ingersoll-Rand, Ltd
Two, 324 cfm, 350 psig for soot-blowing chemical-recovery boiler; one, 125 cfm, 100 psig for lancing recovery boiler; two, 326 cfm, 100 psig for mill air supply; one, 84.5 cfm 100 psig for instrument and control air supply

Air-compressor motors — Canadian General Electric Co, Ltd

Air compressor-motor starters — Canadian Cutler-Hammer, Ltd

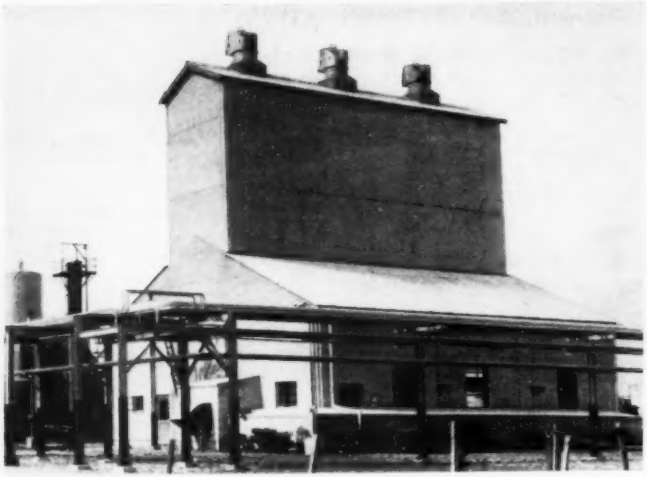
Elevator, electric, serves all boiler-house floors — Otis-Fensom Elevator Co

feed being controlled by positioning the gates.

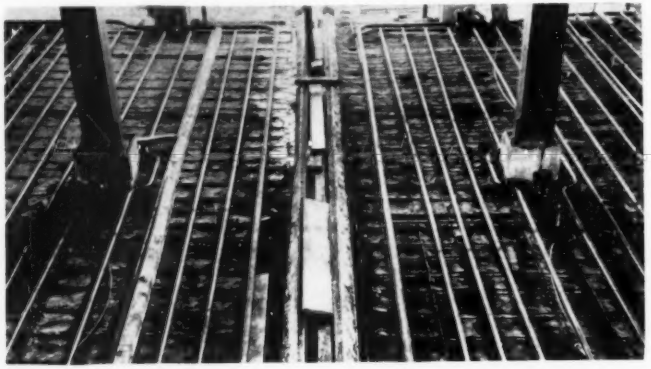
Coal delivered to the mill by rail is put into the 360-ton bunker by a bucket elevator and a flight conveyor. From the bunker, the coal goes to the pulverizing system of two feeders, one ball mill and two exhausters per boiler. The ball mills are in the basement while the feeders and exhausters are on the operating floor. Gates on the bunker, just above the refuse flight conveyor, permit emergency firing of coal in the dutch oven.

**Design and Equipment.** Design work and equipment selection were by our Montreal office in close cooperation with the engineering department of Kimberly Clark Corp, Neenah, Wis. W O Wallace spent much of his time in our offices in Montreal, while W Lundy, of the operating department, shuttled back and forth at frequent intervals. It should be pointed out that the steam boilers and refuse furnace, at Niagara, Wis., are prototypes of the units in this installation. To a great extent they were developed by Lundy, and much of the credit for the excellent operating characteristics developed by these units goes to him.

Both Lundy and Wallace paid close attention to our layouts and, wherever practical, they duplicated in the Long Lac boiler house the operating features of other Kimberly Clark installations, so operators would feel as much at home as possible. Structural and architectural drawings were made by Surveyer, Nenninger & Chenevert, consulting engineers, Montreal, who worked under arrangement with our office.



1 Radiant-heating system has been put in this experimental chemical laboratory. Here specifications called for 60 air changes per hr, a total of 60,000 cfm



2 Grid system, for heating job in Fig. 1, proved able to meet heating load without separate air preheating because last winter had no extremely low temperatures

3 Sinuous radiant-heating coil successfully supplies heat to a building designed for sand-blasting operations. Other heating systems posed maintenance problems

**Since its beginning radiant heating has been faced with imaginary limitations. But almost as soon as they're advanced the industry goes about removing them. Here's the latest on what you can do with radiant-heating systems**

By **ENGINEERING SERVICE DEPT**
*A M Byers Company*

# Radiant

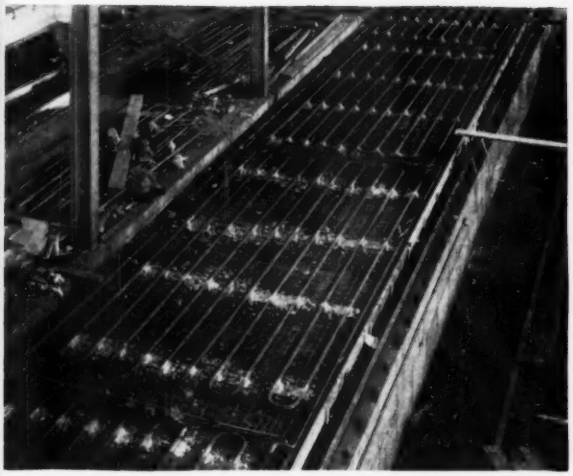
► RADIANT HEATING made its start in this country under a cloud of controversy. And almost ever since, its progress has been marked by more argument.

Frank Lloyd Wright, a controversial figure in the architectural field, first specified radiant heating in this country for a new office building of the Johnson Wax Co. That touched it off. From then on almost every new application has been questioned.

But over the years thousands of case histories have been recorded in the files of manufacturers. For instance, at A M Byers Co, as a guide to further research, the Engineering Service Dept constantly works over the files. What's more, these same files give testimony to the soundness of many applications originally hotly debated.

From these findings four general advantages appear for every radiant-heating installation. They are: (1) A complete use of floor area is possible, with no space lost to radiators or duct work. (2) No outside dirt or pollution enters through the heating medium to taint inside air, wall or ceiling space. (3) Comfort heating takes in the zones above every square foot of flooring. (4) Fuel costs are reported to average a 10 to 25% saving.

At the present time 16% of all radiant-heating installations are in industrial plants. The remainder further divides among residential, commercial



**4** Diesel railroad shop employs sinuous-coil radiant heating for both the indoor comfort and outside platform safety

**5** Ramp with 10%-grade 30-degree turn, carried all-weather traffic; needed built-in snow removal for optimum service

# Heating Turns Problems Into Progress

and specialized buildings and structures.

Size of the industrial installation varies all over the lot. Some may be for service in a railroad shop like Fig. 4, an experimental laboratory, Fig. 1 and 2, or even a chicken brooder.

The heavy percentage of radiant-heating installations have gone into one-story buildings. About 73%, in fact. But behind this figure lies the fact that single-story buildings are often preferred for production planning and material-flow reasons. Not because radiant heating works best in such buildings. There are a number of multi-storied structures experiencing success with radiant-heating systems.

There seems no sharp preference for grid, for instance, as against sinuous-coil construction. The selection practically balances, 55% listing the sinuous type and 45% the grid.

**Applications.** Fig. 1 and 2 illustrate one of the most interesting radiant-heating layouts on record. The building is the general experimental laboratory of a chemical corporation. It tests the scale models of production-plant units for various chemical-processing operations. The building designers called for 60 air changes per hr, totaling up to 60,000 cfm.

With such a change of air, preheating the incoming air seemed necessary. So four 25,000-cfm fans mount on the roof to remove the interior air and draw replacement air into a plenum chamber for preheating. Last winter, with no extremely low temperatures, was so mild that the radiant-heating system carried the load alone!

**6** Snow removal—an outgrowth of radiant heating—has become a sizeable market for this heating. Many report it costs less than manual snow shoveling did

Another rather special application of radiant heating, Fig. 3, occurs in a sand-blasting building where metal tanks are cleaned before being surfaced with rubber. All exposed heating elements and pipes suffered from too much sand and dust. Air heaters would only add to the problem by agitating the sand laden air. But radiant heating solved the problem neatly.

**Snow Removal.** An outgrowth of radiant heating—snow removal, Fig. 5 and 6—has become a sizeable market on its own. Fig. 6 uses a small residential-type gas-fired boiler to heat water for the coils lying under the sidewalk. An anti-freeze solution in the water prevents it freezing if heater is off.

A flick of a switch when snow falls,

and the gas burner goes on, the circulating pump starts up, and warm water flows through the coils to melt the snow as fast as it lands.

A somewhat more expensive installation, Fig. 5, keeps an 85-ft ramp with a 10% grade and a 30-degree turn free of snow and ice. Snows from 18 to 30 in. have not managed to stick. The system melts snow at a rate of 2 in. per hr. If turned on at the beginning of a fall it melts upon contact.

**Installation.** Both the industrial and the domestic user are interested in the installation procedure. The industrial user is, perhaps, more so. He has an investment that needs a fairly long-run protection.

Once a factory floor is laid, for example, over a radiant-heating grid or coil the plant owner wants to be sure he can mount equipment on that floor, or carry on various operations without any delays from heating-system failures. So a number of advice points based on field experience have been compiled, applying in the main to wrought-iron installations that A M Byers makes. They are as follows:

**Assembly.** (1) Concrete flooring is favored over other forms by an overwhelming number of industrials. (2) Manual oxyacetylene or metallic arc welding is most generally used for wrought-iron welding. (3) Standard power or hand equipment, either in shop or field fabrication, can be used for cold-bending the ductile wrought iron. (4) Weld all joints wherever possible. It gives a sound, long-lasting coil or grid system.

**Insulation.** (5) Insulation under grid or coils is usually not necessary. Abnormal foundation conditions can change this. (6) Edgewise slab heat losses can be appreciable. Be sure to put in at least a 1-in. insulating strip next to the footer or wall and carry it 18 to 24 in. into the fill beneath the floor. This insulation reduces slab loss to 15%, or less, of the total output of the system. (7) Any non-acid producing good drainage material, such as ordinary gravel, sand or limestone, works fine as a fill. Don't use cinders or other sulphur-bearing material. They react with moisture to form highly corrosive sulphuric or sulphurous acids.

**Piping Location.** (8) Where you put the radiant-heating coils or grid in, the slab seems to have little effect. Satisfactory results are reported with piping embedded at a low level, or set squarely in the middle of the slab thickness. (9) Allow a concrete cover between floor surface and pipes equal to the outside diameter of the pipes, or 2 in.—whichever is greater. Where a finish floor covering is planned, hairline cracking may not be objectionable. You could use a thinner covering. (10) How about expansion joints? In general, you don't need them. Wherever the concrete-floor installation is large enough to require expansion joints in the slab itself, they should provide for pipes crossing the joints. Accepted practice designs floor layouts so only the mains cross expansion joints. This keeps wrapped expansion loops at a minimum.

**Piping Size.** (11) Heat loss in each room determines amount of pipe that room needs. You can convert heat loss into feet of pipe with this formula:

$$P = \frac{HL}{3.5 \times A \times dT}$$

where $P$ is linear ft of pipe; $HL$, total heating load in all directions from piping; $A$, external pipe-surface area per linear ft; $dT$, temperature difference, water to room air; 3.5, a constant for concrete floors or plaster ceilings. (12) Next comes pipe diameter. Friction resistance to flow is usually limited to 300 mil-inches per foot of main so the circulator won't be too large. Usually residential or office installations plan a 10-F temperature drop through the system. Factories or garages accept 20 F. But knowing temperature drop and heat loss for a building you can compute the gpm to be circulated by:

$$\text{gpm} = \frac{\text{total Btu per hr required}}{500 \times \text{temperature drop}}$$

With this figure, standard tables for frictional flow give proper main size. (13) What determines choice of a grid pattern or a sinuous-coil construction? Again, circulator size is a limitation. As a rule of thumb for a 10-F temperature drop a grid proves best where pipe in a single area exceeds 300 ft of 1¼-in. pipe, or an equivalent hydraulic length for other sizes and other temperature drops.

**Pipe Drainage and Venting.** (14) Try for a slope of ¼ in. to every 10 ft of pipe for positive drainage. Otherwise, install a compressed air fitting in the piping system so you can blow out water when you want to. (15) Be sure the system can vent itself. These methods give adequate venting: (a) manual or automatic vent at top of each vertical riser (b) vent at points where flow changes from horizontal to downward (c) main vent at the boiler itself.

**Safe Design.** (16) What is the greatest heat output in Btu per hr per sq ft for safe design? Here purely theoretical estimates do not agree with practical findings. So a compromise is in order. A design for 75 to 80 Btu per hr per sq ft seems safe for 70-F rooms without any danger of uncomfortable floors.

These points of advice are only an indication of the technology that has grown up on radiant heating. They give promise of still further advances and development in this addition to the heating industry.

## Radiant-Heating Design Factors

► THE PRIME factor of design in a radiant-heating system is to determine the minimum size of a given type of panel heating that will still establish comfort under extreme outside conditions. Secondary objectives are those of fixing the temperature of the water, the tube arrangement for the panel, total heat loss from the structure.

Design factors break down into two main groups: (1) Those that can be assigned numerical value before the design is started. (2) Those that are evaluated as a result of design procedure.

**Known Factors.** Weather Bureau or Handbook Data gives outside air temperature and establishes the expected extremes. The panel surface temperature is the temperature at which the panel would be expected to operate under full load. Limitations result from structural considerations — cracks in plaster, etc.

Ventilation rate in air changes per hr depends upon whether it occurs by infiltration or by mechanical means. If mechanical equipment is used multiply cfm of outside untempered air by 60 and divide by room value. If infiltration does the ventilating go to the *ASHVE Guide* for leakage quantities.

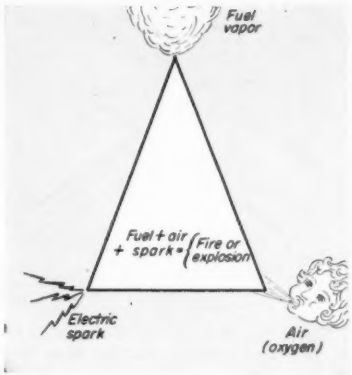
Again, the *ASHVE Guide* helps you calculate the over-all coefficient of heat transfer for the materials used.

Allowable temperature drop of hot water through the panel is usually held to 10 F or less.

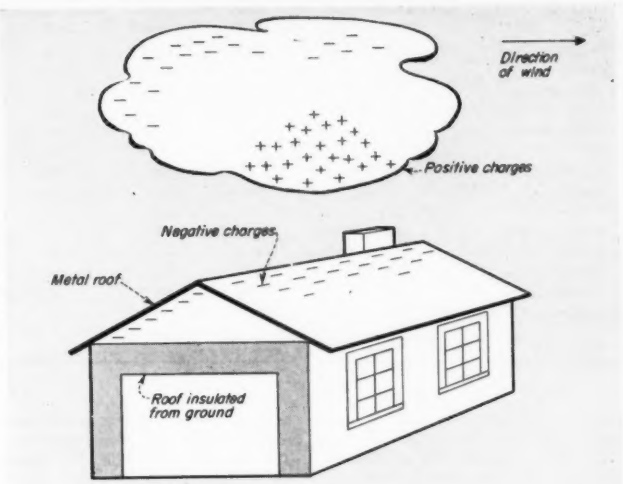
**Unknown Factors.** Those factors, on which no immediate value can be set but which depend on design procedure, are (1) panel area (2) panel rating, Btu per hr per sq ft and required energy input (3) room-air temperature (4) flow rate and temperature drop of water (5) sizing and spacing of tubes (6) mean radiant average temperature.

From *A Graphical Design Procedure for Radiant Panel Heating*—F W Hutchinson—Revere Copper and Brass.

## PASSING CLOUDS ARE POTENTIAL SOURCE OF STATIC CHARGES




**1** Requisites for any fire or explosion are fuel, oxygen and ignition source. Trouble starts when electrostatic spark from moving stock sets off fuel vapor




**2** Electrification of insulated metal roof by induction from charged cloud. After it passes, roof is left in charged condition; a potential source of sparks

# Tackling the Electrostatic Problem

**Electrostatic discharges may mean fires, explosions, material wastage, personal injury. Here's the story on generation of static electricity, its accumulation, hazards and control, with the advantages and limitations of popular neutralizers**

By **ROBIN BEACH**
*Head of Robin Beach Engineers Associated, Brooklyn, N.Y.**

► WHEN TWO DISSIMILAR SUBSTANCES make contact they become electrified. One is charged with positive electricity, the other with negative. If one is an electrical insulator, each substance holds its charge when they are separated. This shows up as a voltage difference between the two bodies.

**Fundamentals.** A homely example of this electrostatic charge is the spark that a person draws when reaching for a door knob after walking across a rug on a winter day. This discharge is seldom harmful. But in industry, electrostatic sparks are potential sources of fires and explosions wherever flammable mixtures of gases and vapors are present.

There are three components to any fire or explosion: flammable gas, an electric spark, and air, Fig. 1. Keeping this in mind look at the upper and lower flammability limits of fuel vapors in the table on the next page. Note hydrocarbon fuels have a rather narrow flammability range: around 1 to 8%. This means vapors of hydrocarbons are explosive when they constitute between 1 and 8% by volume of an air mixture. Further examination of this table shows that many commonly used gases and vapors may be ignited throughout a wide range when mixed with air.

Most commercial solvent vapors are between two and four times heavier than air. Hence these vapors sink rapidly to the floor, spread over it, and fill any pockets and low enclosures. This is why a fire sometimes winds up as an explosion of confined air-fuel mixtures. The table also shows that many of these liquid fuels have such low boiling points that vapors are given off freely at room temperatures.

**Generation.** Static electricity is generated in nearly all operations involving stock passing over rolls. Examples are moving power belts, paper manufacturing and processing, printing, calendering of rubber and a wide variety of plastic stocks, and manufacture of textiles and floor coverings. Since all these materials are good electrical insulators they can build up a high electrical charge.

Fire or explosion hazards come into the picture when an electrostatic spark ignites vapors given off by a commercial solvent. Generally a fire takes place in open space and an explosion in an enclosure.

Static electricity is also generated by

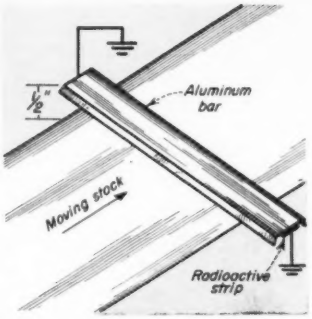
*The author is also Associate of McCrossin & Co, Engineers, New York, N.Y.; and Adjunct Professor of Electrical Engineering, Polytechnic Institute of Brooklyn, Brooklyn, N.Y.

## PROPERTIES OF FLAMMABLE LIQUIDS AND GASES

| Name | Explosive limits, % vol Lower | Upper | Vapor density Air = 1.00 | Auto-ignition Temp deg F | Boiling point Deg F |
|---|---|---|---|---|---|
| Acetylene (gas) | 2.5 | 80 | 0.91 | 635 | −119 |
| Benzol | 1.4 | 8 | 2.77 | 1076 | 176 |
| Butadiene (gas) | 2.0 | 11.5 | 1.87 | — | 24 |
| Carbon disulphide | 1.0 | 50 | 2.64 | 257 | 114 |
| Carbon monoxide (gas) | 12.5 | 74.2 | 0.967 | 1204 | −314 |
| Ether | 1.7 | 48.0 | 2.55 | 366 | 95 |
| Ethylene (gas) | 3.02 | 34 | 0.975 | 1009 | −155 |
| Gasoline | 1.3 | 6 | 3 to 4 | 495 | 100 to 400 |
| Hexane | 1.25 | 6.90 | 2.97 | 477 | 156 |
| Hydrogen (gas) | 4.1 | 74.2 | 0.069 | 1076 | −422 |
| Methyl ethyl ketone | 1.81 | 11.5 | 2.41 | — | 176 |
| Petroleum ether | 1.4 | 5.9 | 2.50 | 475 | 100 to 160 |
| Propane (gas) | 2.37 | 9.5 | 1.56 | 871 | −45 |
| Toluene | 1.27 | 7.0 | 3.14 | 1026 | 232 |

Bulletin No. 36.10, Associated Factory Mutual Fire Insurance Co

## HERE ARE THREE...




**3** Radioactive elements such as radium, thorium and polonium pre-ionize air

flow of gases and many types of liquids in pipelines. Hydrogen is an example of the former and gasoline of the latter. In addition to fire and explosion hazards, static electricity often damages stock.

Another form of hazardous electrification is induction from a charged cloud, Fig. 2. When a positively charged cloud passes by, negative charges are drawn toward it in all tall objects in the area. For example, tank trucks parked on a concrete apron have been thus charged to an extremely high voltage. Because of the high resistance of concrete on which tires rest it may take an hour or more for the shell of the truck to become highly electrified by attraction of negative charges from the ground. Should the cloud discharge to another cloud or float away the truck is left in a charged condition. The truck is then a potential source of sparks in addition to being a shock hazard.

Elimination of hazard from electrification by induction lies in thoroughly bonding and grounding all exposed metallic parts, such as metal roofs, tank cars and trucks, elevated tank structures, etc.

**Control of Static.** Attempts at control have ranged from use of fragile tinsel to expensive radium units costing between $200 and $300 each. Although equipment grounding is important it does not eliminate generation of static electricity. The real problem is to dissipate the static electricity that accumulates on the stock. In general, there are two ways to do this: (1) humidification (2) ionization or breaking down of surrounding air.

Dissipation by humidification is generally unsatisfactory. If relative humidity of about 65 to 80% is maintained, static electricity will leak to ground, but the high moisture content is frequently harmful to the processed product. A more conventional method for elimination of static accumulation is to use devices that ionize the air close to the electrified stock. All these devices may be divided into the following classifications: (1) high-voltage, separately energized discharge points (2) radioactive discharge bars (3) self-energized points.

**Electrified Points.** High-voltage, separately energized discharge points have been used for many years in the textile and printing industries. The metallic points are supported by, but insulated from, a bar placed across the stock, Fig. 5. The insulated wire within the bar is fed from a high-voltage source; generally ac at 10 to 15 kv. Strong electric field about the discharge points breaks up or *ionizes* the surrounding air into positive and negative charges. Since electrified stock is generally negative the positively charged air ions are strongly attracted to the stock. In this way the negative charges on the stock are neutralized by the positive ions of the air as rapidly as they are formed. Several such static neutralizers are manufactured and are generally satisfactory.

High-voltage static neutralizers have many disadvantages in addition to inherent advantages. Since high-voltage wires must be run from the transformers to the units, the problem of current leakage and electrical failures crops up. Then there is the added possibility of sparking from the high-voltage leads, introducing a fire and explosion hazard. Hence underwriters do not allow this equipment to be used in enclosures where potential explosion hazards may exist.

**Radioactive Elements.** Radium, thorium and polonium are examples of the second class of neutralizers, Fig. 3. They are based on the principle of preionization of air. Of these, radium is by far the most powerful and enduring. One drawback in the use of radium is that it gives off gamma radiations. These are, generally speaking, like X-rays. Gamma radiations cause injury to skin tissue if received over long periods.

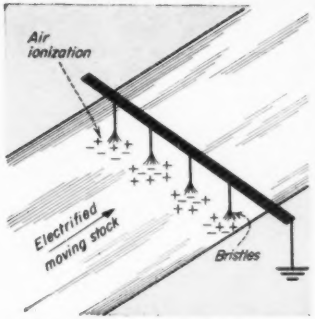
Polonium dischargers have been developed to get around this drawback to radium. This radioactive element doesn't give off gamma radiations. On the other hand, its useful life as a neutralizer is limited to less than one year. Polonium's ionizing capacity is considerably less than that of radium.

Since evolution of the atomic bomb, hundreds of activated isotopes have been introduced. A number will no doubt find their way into the manufacture of neutralizers for the heralded elimination of static electricity in industry. None of these new products will be suitable as static eliminators.

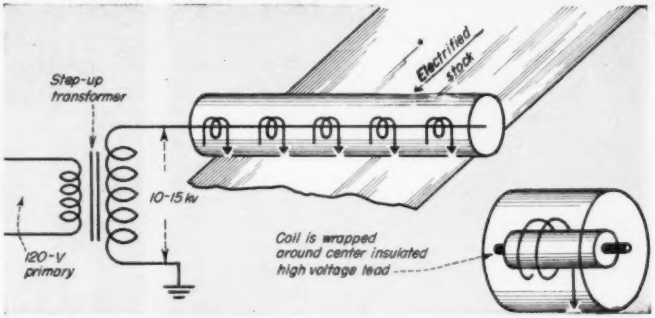
All radioactive neutralizers are costly. On top of that even the most powerfully charged units cannot eliminate static electricity on rapidly moving stock. They are effective, however, in discharging low-electrification of slow-moving stock. Dust and vapor deposits accumulating on these neutralizers absorb much of their radiation, thus cutting down their power of ionizing the air. Nevertheless, neutralizers in this class present a minimum explosion hazard when properly installed where flammable mixtures of fuel vapors are present.

**Self-Energized Type.** Examples of this type are strings of grounded tinsel and arrays of grounded jeweler's wire strung across electrified stock. This type neutralizer has been used in industry for decades. Voltage between the tinsel or fine wires and the electrified stock

## ...TYPICAL DEVICES TO NEUTRALIZE STATIC CHARGE ON BELTS




**4** Charge is neutralized by ionizing air between stock and grounded tinsel




**5** High-voltage ac is fed to insulated lead in tube center. Metallic points connect to coil wrapped around insulated core. Strong electric field ionizes air below

ionizes the intervening air. This results in neutralization of the charged stock. Although such devices have often been effective, almost daily replacement of the fragile materials is a costly item when labor charges are included.

Metallic bristles in this class of neutralizer are attached to, and mounted on, a grounding bar. How they are constructed determines the effectiveness of these self-energized neutralizers. Units are available that are designed for use on high-speed, highly electrified stock in various industrial processes.

Limitation of all such self-energized neutralizers lie in their inability to neutralize the ambient air. Hence they fail unless the stock is sufficiently charged to produce the minimum voltage necessary for air ionization.

**Other Considerations.** Every problem in electrostatic hazards can be solved. Methods and devices outlined above apply only to simple cases involving movement of stock through various types of processing operations. Hand operations that introduce electrostatic hazards require correlation of engineering principles not covered in this brief article. For electrostatic hazards on vehicles, solutions are radically different from conventional problems.

Then, too, resolution of difficulties in film processing requires still other approaches in elimination of electrification. Safety in the operating room from lung explosions caused by anesthetics is a technique requiring still further ingenious methods of solution.

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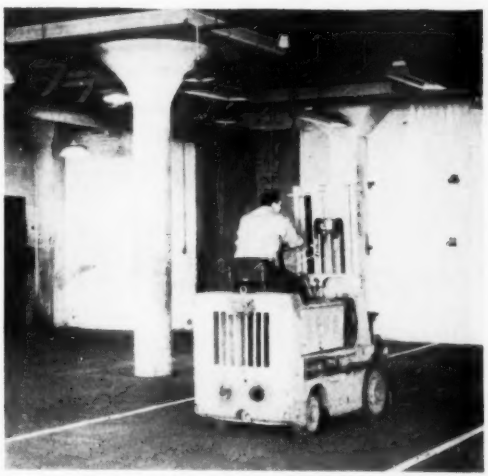
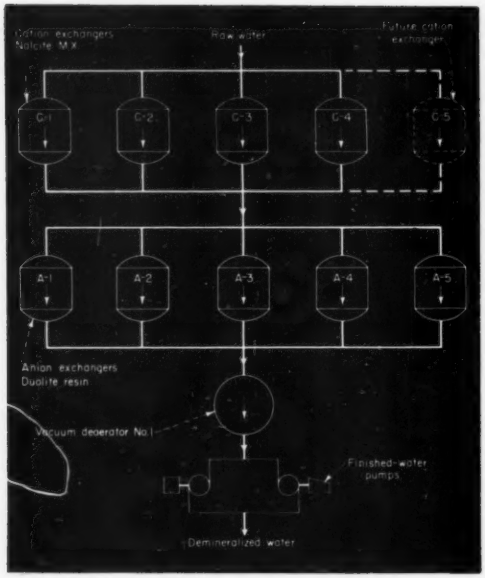
# Will Your Floor Support That Power Truck?

► COMMON-TYPE INDUSTRIAL TRUCKS impose a dynamic floor load about one and a half times static weight of the loaded machine. Considering the truck as a concentrated load, bending moment is about twice the bending moment for uniform loading. These two factors alone indicate industrial truck operations introduce floor stresses three times those under uniform loading.

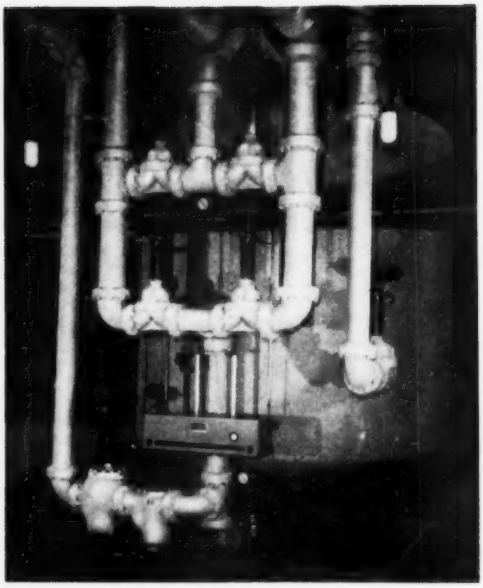
To actually determine the truck load a floor will carry, let us consider a 20x20-ft bay with a 10-ft aisle. Rated floor capacity is 250 psf, or 50,000 lb. Using the factor of three, this would allow a truck weight of 16,600 lb. This holds for concrete-slab type floors. Just how much of this weight will be apportioned to truck and how much to load depends on individual case.

It is assumed that storage areas along the aisle are not overloaded. Two or more trucks can pass one another in this bay provided their combined weight is not greater than 16,600 lb. This factor should be carefully considered in front of elevators. Further studies may be needed for other type floors—for instance, wooden floors where only a few boards receive the truck's full weight. Where this rule-of-thumb indicates the weight of the loaded truck approaches maximum safe floor load, a detailed study should be made.






**1** First unit has all cation units grouped to discharge into headers feeding anion group. Beyond them is the deaerator

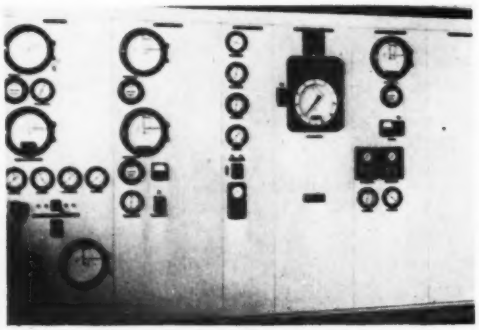


**2** Cation units have 5-ft resin beds supported on 12 in. of graded anthracite. Fluoride is injected to remove silica

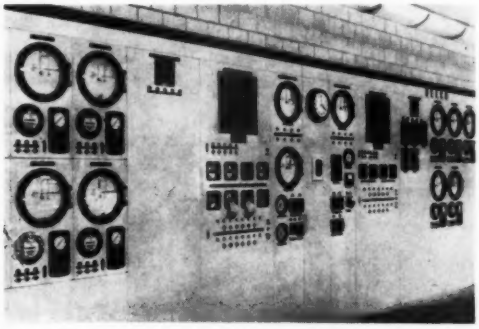
# Demineralization Supplies 100%

**When high-pressure boilers operate with 100% makeup, water entering them must be treated skillfully to avoid troubles that give engineers nightmares. Here's how Dow Chemical Co solved the problem of silica removal for its new cyclone-furnace-fired unit by use of fluoride and demineralization***

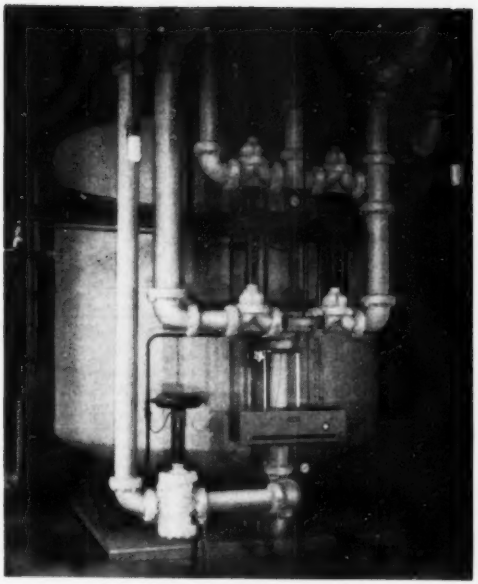
By **LOUIS WIRTH JR,**
*Power Division,*
*Dow Chemical Co*



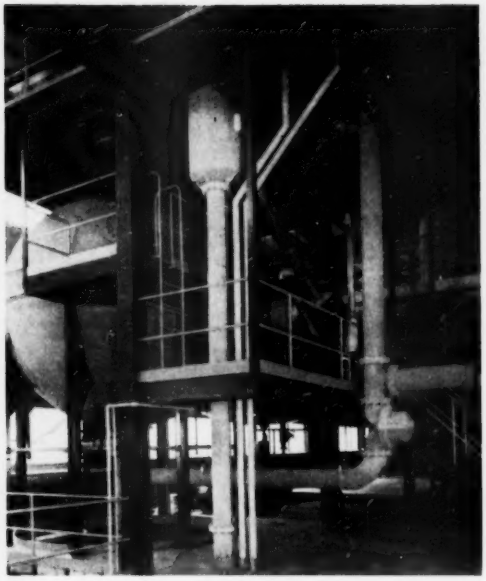
**5** A service panel meters the plant utilities and raw water needed for operation. It also records the anion effluent



**6** Operation and regeneration panel mounts valve diagrams, flowmeters and controls for both cation and anion units



**3** Anion units have monel under drains. Other piping between anion and cation units, except raw-water, is rubber lined



**4** Bitumastic-lined, spherical design, atomizing vacuum deaerator uses a 3-stage ejection and an after-condenser

# Makeup for 1250-Psi Steam Generator

► DEMINERALIZATION GIVES a good account of itself in treating 1500 gpm of feedwater at Dow Chemical Co's plant in Midland, Mich. to supply 100% make-up for a 1250-psi steam-generating unit, as well as process.

**Plant Flow Diagram.** The plant operates on the header system, Fig. 1. All cation units are grouped to discharge into one header which, in turn, feeds a header common to the anion units. Discharge from the anion units goes direct to the deaerator, and then to the power plant. Cation-exchanger shells, Fig. 2, measure 11½ ft in diameter and 11 ft high on the straight side, and are equipped with hard-rubber underdrains laid directly on the shell bottom.

The 5-foot resin bed lies on anthracite coal graded to 12 in. above the dished bottom, and there is 100% freeboard available for backwashing. The monel-metal acid lateral is 12 in. above the resin bed. A submerged lateral of monel was designed in the original cation exchangers, 20 in. from the bottom of the bed, as a means of injecting calcium fluoride for silica removal. Cation exchangers are designed for 5 gpm per sq ft of surface, three units operating and one off for regeneration, to maintain a flow rate of 1500 gpm.

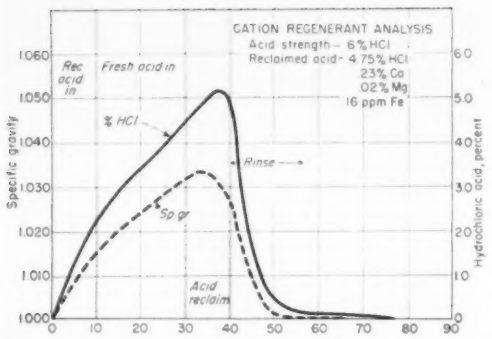
Each anion exchanger, Fig. 3, is 12 ft 9 in. in diameter by 11 ft high on the straight side, and has monel underdrains. Remainder of anion-unit design is identical with cation units except submerged lateral is omitted and flow rate is 3.5 gpm per sq ft. All unit piping, except that for raw-water is rubber lined. Valves of rubber diaphragm type operate pneumatically. Effluent valves are double-port monel-trimmed with lined body, which permits flow regulation of the individual units when they operate in parallel. The present effluent valves are being replaced with a diaphragm-type device equipped with the same control.

**Deaeration.** The Bitumastic-lined vacuum-type, atomizing deaerator, Fig. 4, uses three stages of ejection. An after-condenser permits recirculating condenser water into the plant operating cycle. The spherical-design deaerator provides a large disengaging area with minimum cost for the vacuum vessel. Operating results of this design have been within the guarantee limits of 2 ppm $CO_2$ and 0.1 ppm oxygen.

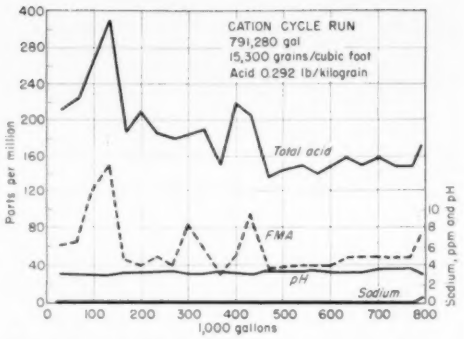
**Control System.** Nerve center of the plant is the control system governing operation and regeneration. A central control room houses a 40-ft instrument panel and laboratory table. The service panel, Fig. 5, meters to the plant the utilities and raw water necessary for operation. Anion effluent to the deaerator is also recorded and plant rate control is regulated by the operator, utilizing this meter as a guide. Located on the control panel are deaerator-operating gages and instruments, as well as instruments that show the analysis of finished water going to the power houses. Conductivity and pH recorder is equipped with a conductivity alarm, which masters individual alarms on the anion exchangers. Blank spaces on the panel provide room for doubling plant capacity.

Also designed for doubled plant capacity is the unit operation and regeneration panel, Fig. 6. Left section

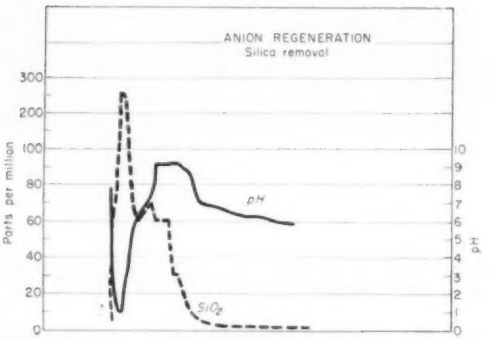
* Presented at the Tenth Annual Water Conference of the Engineer's Society of Western Pa., Pittsburgh, Pa., October 18, 1949.



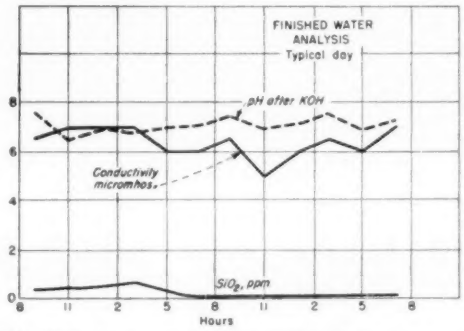

**7** Initial acid for this regeneration was 6% HCl. Acid is reclaimed at peak of concentration for the next regeneration




**8** In spite of erratic changes in the free mineral acidity, caused by sodium fluoride, no sodium leakage occurred




**11** Unless low pH is obtained during acid salt cycle, silica may precipitate when soda ash passes through the resin bed




**12** Finished-water analysis, for typical day's run shows silica content under 0.5 with 50% of run below 0.1 ppm

contains individual cation-unit flowmeters and operating controls. Unit flow rates are regulated individually by the operator, and interlocking of the effluent valve on each unit prohibits regeneration until this valve is fully closed. The cation regeneration-valve diagram aids the operator in following the process and makes detection of faulty valve operation simple. The cation-regeneration control is mounted below the valve diagram.

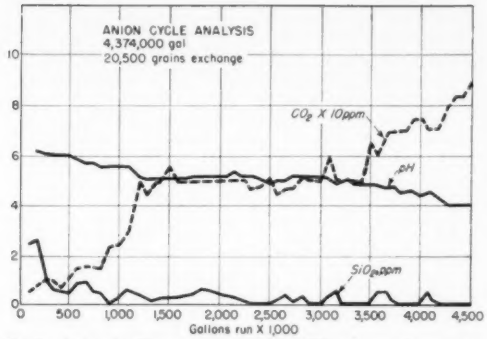
Once a unit is put on regeneration, the cycle goes to completion without manual attention. The chemical storage-tank level recording instrument keeps a record, which checks regenerations if the operator neglects to log such information. Interlocked with the regenerant levels, the regeneration cannot be started unless all tanks necessary for the operation are full, or unless the operator wishes to start regeneration with a tank only partly filled. Then the interlock is cut out by a relay on the panelboard.

**Anion Units.** Right section of the unit-operation and regeneration-control panel contains the individual anion-unit flowmeters and the devices necessary for semi-automatic regeneration of these units. Storage-tank levels are recorded and the regeneration cycle is carried out in sequence similar to that of the cation units. Valve diagram and storage-tank-level interlocks are handled in a similar manner. Conductivity alarms are continuously in operation on each of the anion-unit discharge lines.

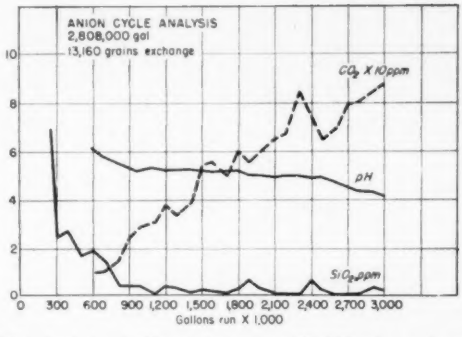
Acid-storage tank is filled by a mixing device that automatically starts when acid pumps are turned on. It is only necessary to set the blending valve once for each strength of acid used. When the storage fills to the prescribed level, the pumps shut off and all valves in operation close. The mixing of each acid batch is recorded in gpm, giving water and acid separately for each tank filling. Anion regenerant tanks are manually charged, with agitator controls operated either from the tank location or the central system mounted on panelboard.

The regeneration-control electrical system is arranged in duplicate to avoid reductions in operating rates from failure of controls during a regeneration. Such an arrangement is costly, but it protects against failures that may occur when the plant is temporarily unattended by maintenance personnel. Since initial electrical difficulties have been corrected, mostly due to dust accumulations during construction, the system has required very little attention.

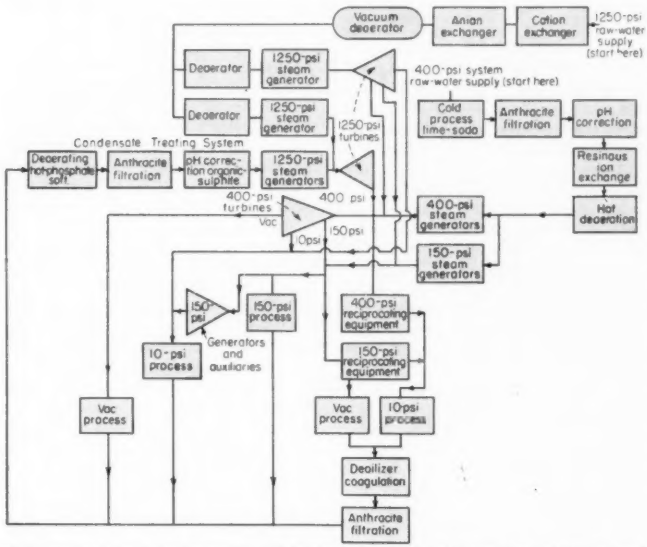
**Ion-Exchange Resins.** Selection of ion-exchange resins for a demineralization process depends on the type of water being processed and the purpose for which it is to be used. Although equipment design is of utmost importance and assuming all contamination from leakage and the like is eliminated, the quality of water obtainable from a demineralizing plant is the direct result of the characteristics inherent in the resins themselves. The ones now available offer more opportunities than those




**9** Analysis of effluent during 4,374,000-gal run shows the pH slowly declining from 6.2 to 4.2 from the held-up $CO_2$




**10** Analysis of effluent during a 2,808,000-gal run shows $CO_2$ variation with the pH dropping as indicated in Fig. 9




**13** Flow diagram of the steam and feedwater cycle showing treating equipment and sources of condensate. Eventually 400-psi boilers will be reduced in number

in use when this plant was engineered and built. From this standpoint, the plant as now operated is no doubt outmoded.

Cation resin employed is the phenol-formaldehyde type, ground. It was selected because operating experience had previously proved it was an excellent choice for the purpose and because its capacity was thought to be correct to give the length of run desired between regenerations. Another attractive characteristic is its ground form, which we thought made it better suited for the retention of calcium fluoride to be used in removing silica. Chief factor in demineralization is to select a cation resin that permits operation without sodium leakage. Acid efficiencies can be kept in line with the operating capacity available when the resin is actually placed in service in a large exchanger unit.

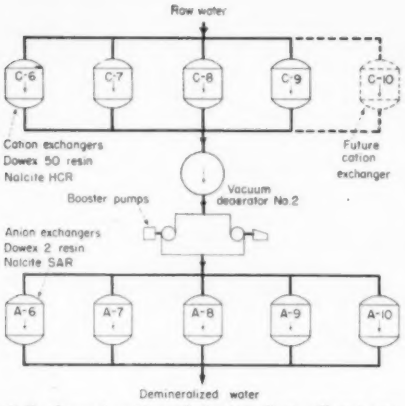
The anion resin was selected for its ability to deliver a water low in bicarbonate as determined during research studies. Test runs in a pilot plant with the aminated phenol-formaldehyde resin, Duolite low capacity, showed that water could be produced, having less than 10 micromhos conductance and containing practically zero silica when using a fluoride. This resin effects a change in $CO_2$ content of the effluent water somewhat and this factor must be kept in mind when operating multiple units and in selecting and sizing the deaerating equipment.

**Regeneration Procedure.** The cation regeneration was originally set up for a 20-min backwash followed by recycled acid, fresh acid, lateral rinse and acid reclaiming, rinse, calcium-fluoride injection through the submerged lateral, recirculation of the fluoride, and then placing on the line. Backwash time was eventually increased to 30 min to rid the resin of accumulated silt. Regeneration with hydrochloric acid simplifies the process because high acid concentrations can be used with no danger of precipitating salts as is characteristic when using sulphuric acid, unless it is carefully handled. Regeneration with hydrochloric acid also aids in keeping the bed relatively free of foreign matter.

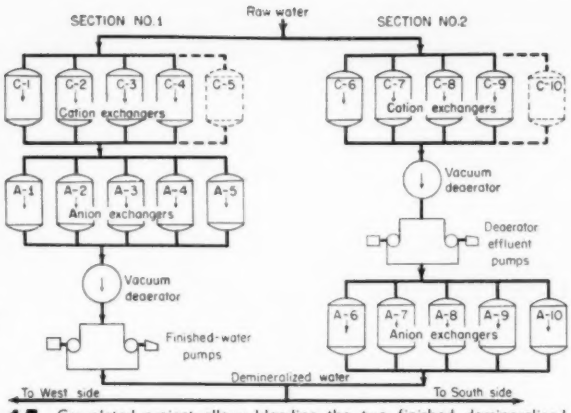
In Fig. 7, effluent acid strength and specific gravity of the regenerant liquor is plotted. Initial acid strength for this regeneration was 6.0% HCl and the recycled acid 4.75% HCl, making a total acid use of 6.8 lb per cu ft and a makeup acid requirement of 4.3 lb per cu ft.

With this dosage, capacities from 11,800 to 17,600 grains per cu ft have been obtained. At 17,600 grains, acid makeup requirement amounts to 0.255 lb per kilograin as calcium carbonate. A cation operating-cycle analysis, Fig. 8, shows sodium content maintained at zero until exhaustion of the unit. In spite of erratic changes in the free-mineral acidity, which are caused by doses of sodium fluoride, no sodium leakage exists with this resin.

**Silica Removal.** Early in the operation of the cation exchangers, using calcium fluoride as the silica-removal




**14** Second section of demineralizer will not use fluoride so deaerator precedes anion units




**15** Completed project allows blending the two finished demineralized waters to give product ideally suited for use with low $CO_2$ content

agent, it was discovered that insufficient fluoride was being carried into solution because of the low free-mineral acidity of the cation-treated water. Also silica removal was not good: It was reduced to 1.0 ppm from the original raw-water content of 2.0 ppm. Supplemental soluble fluoride feed was tried, and finally the calcium fluoride was omitted entirely. Fluoride in the form of the sodium or ammonium salt, now added in quantity of 150% of theoretical requirements, gives satisfactory silica removal.

Sodium is held continually at zero until the cutoff point is reached. This is set at 1.0 ppm by the aid of a Perkin Elmer Flame Photometer. The instrument also serves to locate leakage from mechanical trouble in valves, etc.

Anion-regeneration control is accomplished the same as with cation regeneration. Steps in the procedure are backwash, silica removal with an acidified salt solution, soda-ash addition, lateral rinse and final rinse. Soda ash previously reclaimed was in bicarbonate form, which was neutralized with caustic soda before use. Because of the high silica content of the recycled material, this step in the process was eliminated. The recycled quantity has been replaced with an equivalent amount of caustic soda, which serves to neutralize the excess acid without foaming and gas binding. This is followed by the soda ash, which maintains a satisfactory rinse rate with the resin being used.

**Carbon Dioxide.** Fig. 9 plots the analysis of the effluent during a run of 4,374,000 gal. The pH value during this cycle shows a steady decline from 6.2 down to 4.2. This is due to $CO_2$ held up during the early part of the cycle and later discharged in amounts in excess of that entering the resin bed.

Silica removal, a function of individual anion units, also plotted in Fig. 9, shows the effects of adding fluoride to the cation exchangers during the anion-unit run. Fig. 10, a shorter run of another unit, shows more clearly the $CO_2$-content variation. Raw water has a total alkalinity of 85 ppm as calcium carbonate, whose equivalent in $CO_2$ is

## TABLE I — COST OF DEMINERALIZATION

**Exclusive of building, equipment and operating costs**

| | | | TOTAL | UNIT* |
|---|---|---|---|---|
| **CATION-REGENERATION COST** | | | | |
| Backwash Water | 18,000 gal @ | 12¢ | $ 2.16 | |
| Hydrochloric Acid | 2,240 lb @ | 3.55¢ | 79.50 | |
| Pre-rinse | 3,120 gal @ | 12¢ | 0.38 | |
| Rinse | 30,000 gal @ | 12¢ | 3.60 | |
| Wash water and chemical costs for 800,000-gal production | | | $ 85.64 | 10.71¢ |
| Water cost | 800,000 gal @ | 12¢ | 96.00 | 12.00¢ |
| Total cost cation-treated water | | | $181.64 | 22.71 ¢ |
| **ANION REGENERATION COST** | | | | |
| Backwash water | 12,000 gal @ | 12¢ | $ 1.44 | |
| Salt | 4,000 lb @ | $10.00 per ton | 20.00 | |
| Hydrochloric acid | 250 lb @ | 3.55¢ | 8.88 | |
| Soda ash | 3,200 lb @ | 1.68¢ | 53.70 | |
| Rinse water | 86,000 gal @ | 22.71¢ | 19.50 | |
| Wash water and chemical costs for 3,000,000-gal production | | | $103.52 | 3.45¢ |
| Sodium fluoride | 300 lb @ | 12¢ | 36.00 | 1.20¢ |
| Cost including fluoride | | | $139.52 | 4.65¢ |
| **COMBINED REGENERATION COST** | | | | |
| Cation-treating cost | | | | 10.71¢ |
| Anion cost | | | | 3.45¢ |
| Fluoride cost | | | | 1.20¢ |
| Raw-water cost | | | | 12.00¢ |
| Total cost including raw water | | | | 27.36¢ |

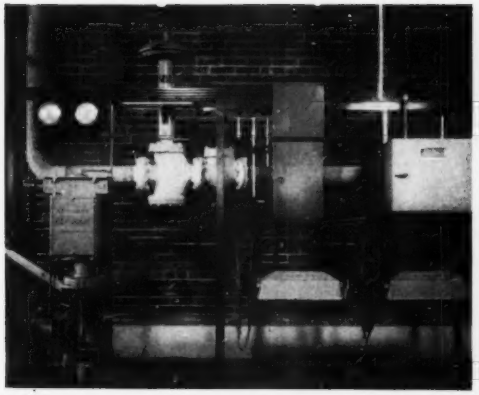
* Cost per 1000 gal

## TABLE II — ANALYSIS OF 1250-PSI BOILER WATER

**Using makeup that is 100% demineralized**

| Aug. '49 | KCl | "P" | "M" | $PO_4$ | $K_2SO_3$ | $SiO_2$ | F | Fe | pH | Cond., mm | Turb. | Water, million lb | $K_2HPO_4$ lb | $K_2SO_3$ lb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 37 | 42 | 72 | 29 | 12 | 10.5 | 2.8 | .14 | 10.7 | 580 | .6 | 7.20 | — | 4.5 |
| 2 | 36 | 36 | 62 | 22 | 10 | 4.5 | — | .12 | 10.5 | 580 | .2 | 9.00 | 12 | 4.5 |
| 3 | 45 | 28 | 54 | 24 | 10 | 6.5 | 3.1 | .10 | 10.4 | 600 | .3 | 8.80 | 13 | 5.7 |
| 4 | 30 | 36 | 68 | 21 | 10 | 10.0 | — | — | 10.5 | 610 | .8 | 9.16 | 14 | 5.3 |
| 5 | 22 | 30 | 58 | 29 | 8 | 7.0 | — | .08 | 10.5 | 480 | 1.0 | 8.25 | 14 | 5.6 |
| 6 | 22 | 22 | 46 | 20 | 8 | 8.1 | — | .22 | 10.3 | 480 | 1.15 | 9.07 | 10 | 5.0 |
| 7 | 45 | 22 | 50 | 24 | 10 | 6.5 | — | .22 | 10.2 | 525 | .95 | 9.65 | 15 | 5.7 |
| 17 | 60 | 24 | 60 | 18 | 10 | 8.1 | — | — | 10.5 | 500 | — | 9.10 | 13.5 | 5.2 |

All figures in PPM unless otherwise indicated.



**16** Acid-storage tank is filled by this mixing device, which operates automatically when the acid pumps are started

**17** Photometer determines cutoff point and proves useful in locating leakage caused by mechanical faults in system

usually reached and surpassed before the anion unit runs out. Water treated, during the cycle of the unit just discussed, amounted to 2,808,000 gal, or 13,160 grains per cu ft as calcium carbonate.

Anion rinse-water requirements vary somewhat with different regenerations, mostly because of the indifference with which silica comes out of the bed. It usually requires 90 gal per cu ft to rinse out all constituents except silica, and sometimes as much as 200 gal per cu ft to reduce silica to the desired point.

Regeneration with soda ash has caused some difficulties, one being gas binding. This is the most troublesome when sufficient acid is used prior to the soda ash to facilitate silica removal.

Removal of silica from anion bed is a function of pH and regenerant concentration. If sufficient acid is not passed through the bed during the acid-salt cycle, Fig. 11, some silica is left to be removed when the soda ash passes through the bed. This is illustrated when comparing the silica content of the regenerant waste with the pH value. Previous data show that, with less acid, a second bump in the silica concentration occurs later in the cycle. Exact significance of this is not yet known as far as the danger of precipitation is involved, but we do know that lower rinse rates result when silica is almost entirely removed from the bed with the acidified salt solution.

Data in Fig. 11 were taken during a regeneration following a relatively short run, so only about 22 lb of silica were removed from the bed. Rinse rates have been maintained near 130 gal per cu ft with the elimination of the second bump in the silica-removal curve of the anion regeneration. Because of troubles with gas binding, caustic soda will eventually be used for this regeneration.

**Operating Results.** The finished water analysis, Fig. 12, for a typical day's run shows silica content consistently less than 0.5 ppm, with over 50% of the run less than 0.1 ppm. The plant was operated at 700 to 800 gpm during the run. The pH value in this case is raised from about 5.5 with caustic potash (hand controlled) which accounts for a slight increase in conductivity as recorded in micromhos.

**Costs.** Exact performance cost has not yet been evaluated because of many conditions beyond operating control. Excessive water loss has resulted from leakage, which has only recently been improved by redesign of equipment. Table I shows that water costs, including chemicals, wash water, and cost of water being processed, runs about 27c per 1000 gal. Improvements in operation may eventually reduce this figure.

**Results in Boiler.** The water being produced by this process is now supplying a 1250-psig 400,000-lb-per-hr cyclone-furnace steam generator. The added capacity will supply two similar boilers under construction. Table II lists the analysis of the concentrated boiler water along with other treatment data for several days' operation. Blowdown is about 1-1½%, but since it goes to a 400-psig boiler, measuring the water discharged is not feasible. Also, the constituents of the feed-water are too low in concentration to analyze accurately enough for boiler-cycle concentration calculations.

Phosphate dosage to the boiler is listed along with the sulphite. These salts are all in potassium form as early operation revealed that sodium hideout existed in amounts too high for favorable operation. Boiler-operating data with this water are limited at the present time, so it is too early to take much information from the record.

Fig. 13 shows arrangement of the topping turbines and the 1250-psig backpressure machine. The limited condensate returns have been supplemented with the demineralized water as shown. Eventually the 400-psig steam generators will be reduced in number, leaving the turbine to operate on bleed steam.

**Expansion Revisions.** Referring to Fig. 1, the deaerator in the first section is placed after the anion exchangers. Development of better anion resins has permitted revising the flow diagram of the second section of this installation: Silica will be removed without using fluoride. To accomplish this, the deaerator must be placed between cation and anion exchangers, Fig. 14. This necessitates better construction of the deaerator and also rubber lining of the vacuum vessel. Acid-resisting pumps are then needed for repressuring the water.

The highly-basic anion resin will be caustic-soda regenerated, and control will be incorporated into the existing equipment. The completed project, Fig. 15, will allow blending of the two finished demineralized waters. This will give a product ideally suited for our purpose as the water from the newly installed unit will contain no $CO_2$, giving a water of better quality from the plant as a whole.

We wish to acknowledge the efforts of all individuals who contributed to the design and construction of the plant. The project was conceived and completed with the best of cooperation between engineer, researcher and manufacturers of the various equipment employed.

**What do you do when the sand starts to slide out from under the foundation of a big heavy-duty diesel? J B Sims had just that experience at the Grand Haven plant, knows the answers. Here he tells you how. . .**

**AT START OF JOB** temporary floor between existing engine foundations is removed. Steel piling for new unit shows at right, near foundation that gave trouble

# Skillful Underpinning Cures

► THE MUNICIPAL PLANT at Grand Haven, Mich. stands at the edge of Grand River where it enters Lake Michigan. The power house rests on sandy soil, with an underlying sand-and-gravel stratum carrying considerable water. These conditions were, of course, known at the time the first diesels were installed and were taken into consideration. Yet it was with the first of these units that difficulties developed later. What these troubles were, and how we cured them, should be of interest to plant operators faced with similar problems.

**First Foundations.** In constructing these first two foundations, the builders drove 2-in. tongue-and-groove wood sheeting and left it in place. Design was such that loading was not excessive for this type of soil. The overturning moments, however, could be expected to be considerable, since reciprocating masses are relatively large. Any instability would thus be accentuated.

When the third foundation was built, steel-sheet piling (about 4 ft long) was used. The water table had apparently lowered and the wood sheeting of the previous foundations had deteriorated. Sand had slipped out from the side of the first foundation. At about this time, we excavated a trench for a 12-in. cast-iron gravity water line. This disturbance of the sand close to the foundation probably did not help the situation.

Because of the direction chosen for future expansion of the plant, the unit we're concerned with here, actually the first installed, is called No. 3. When, about three years later, the plant was extended, the next engine was installed at the far end and called No. 5. This left a space between it and No. 3 for another engine to be called No. 4.

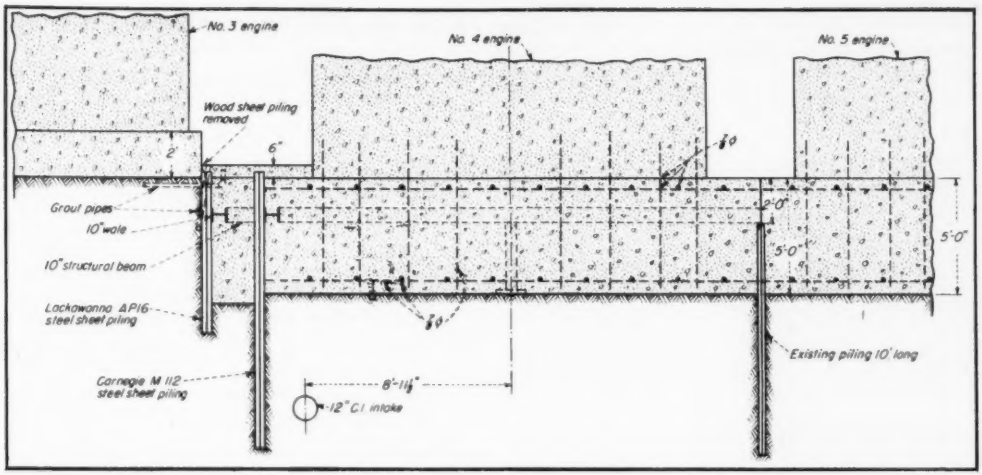
**Design Changed.** Foundation design for No. 5 represented a considerable departure from previous units. The spread of the pad was increased, cupping the sand with interlocking steel-sheet piling. Footings were carried to a greater depth. It was also found desirable to lower the basement-floor level in the extension of the building.

By the time we came to install No. 4, a larger unit, between the existing No. 5 and No. 3, it was apparent that we would also have to do something about the foundation of No. 3. Movement in this foundation had become excessive and it proved difficult to keep pipe connections between it and its auxiliaries in the building. Fortunately, we could find no sign of cracks or breaking-up of the concrete.

**Data Lacking.** We could find little published information on the underpinning and stabilizing of foundations for heavy machinery, although there was plenty of material on bridge, building and similar dead-load foundations. Bearing in mind the added problems of vibrations and movement due to reciprocating and rotating forces, we adapted well-known principles from building-foundation practice and our experience proved them invaluable.

**Load Transferred.** We started by driving an interlocking steel-sheet piling enclosure for the pad or subfoundation of the new No. 4 unit. Existing piling of No. 5 unit formed most of one side of this enclosure (see drawing above). Excavation was made only about 2 ft deep. To carry load from sheet piling on the No. 3 side back to the No. 5 foundation, we put in 10-in. H beams for spreaders, working against a 10-in. H beam used as a waler along the sheet piling on the No. 3 side. The spreaders and waler were set up as tight as possible (with wedges and hydraulic jacks) to prevent any further movement of No. 3 load. Then excavation was completed to a depth of 5 ft and the No. 4 subfoundation poured.

**Underpinning No. 3.** We were then ready to begin underpinning operations on No. 3. We drove another row of interlocking steel-sheet piling tightly against the No. 3 foundation. This replaced the deteriorated wood sheeting on one side and the two ends. The space of about 2 ft between the two rows of piling was excavated to a depth a little greater than that of the No. 4




**UNDERPINNING SCHEME** is shown in section of subfoundation for new engine, No. 4. After this was poured, another row of piles was driven close to No. 3 foundation, space between was filled with concrete, and voids under No. 3 pressure-grouted

# Diesel-Foundation Headaches

subfoundation. H beams again served as spreaders and waler.

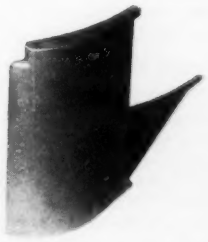
Near the bottom of the No. 3 foundation mat, and the void area, we burned holes into the sheet piling of the No. 3 enclosure. We installed grout pipes and then concreted space between piling.

**Pressure Grouting.** Using an air pressure of 150 to 200 psi, we pressure-grouted through 1-in. and 1¼-in. pipes entering the voids near the edge of the foundation. Grout was forced to return from pipes spaced about one-third the width of the foundation. After it was assured that the grout had circulated in each area, a pressure head was maintained until grout had set.

This job took about 12 hr of continuous work, and about 12-14 wheelbarrows were placed. Probably the biggest difficuty grew out of the tendency of the sand to dry the grout. It was found necessary to use grout of the thinnest possible consistency.

**Results.** With the No. 3 foundation underpinned and stabilized, we completed the foundation for the new No. 4 unit. In the almost eight years since this job was done, we have kept a close watch on the No. 3 foundation. We estimate, conservatively, that at least 90% of the movement in this foundation has been arrested. There is no reaction in the No. 4 foundation, which now carries the side load of the sand.

# Casting Gas-Turbine Blades

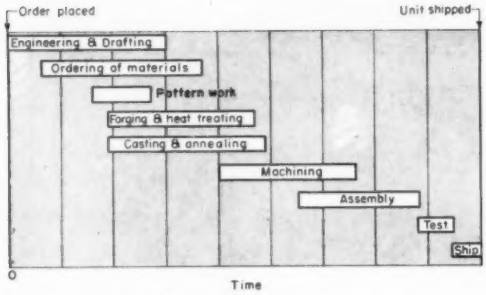


► BACK IN THE MIDDLE AGES, the "lost-wax" process was used to cast elaborately decorated bronze cathedral doors. These were first carved in wax and then "invested" in a semi-refractory plaster. Melting out the wax left the desired form as a void in the plaster. The bronze was then poured in to fill this void.

With this primitive technique, only one casting could be made from each pattern. During the war the lost-wax method was improved and speeded up to permit making gas-turbine blades and similar shapes of refractory alloys too hard for practical machining. The art has now advanced to a point where a major producer in this field, International Nickel Co, casts thin shells like the hollow turbine blade pictured.

To cast such blades on a semi-mass-production basis, INCO first molds wax replicas in quantities, casting the wax in special metal molds. Each wax replica is then invested in plaster to form a mold for one turbine blade.

By E W BURSTADT and C E UNDERHILL, *Turbine Divisions, General Electric Co*




**CONSTRUCTING A TURBINE-GENERATOR** unit involves many steps. Start of each depends on progress of the preceding one

# BUILDING TURBINE SETS TAKES TIME

Turbine Specialist
District Office

Dear Mr Specialist,

Will you please tell me why it takes so long to build a turbine-generator set. The last unit we bought, a 3000-kw set, was shipped six months after we placed the order. I don't remember whether that was considered a long or short time. I see the time has now almost doubled. I'd like to know why it can't be materially shortened.

Just for my own information, will you tell me how changes in design made after the order is placed affect the shipment at various stages in the manufacturing cycle?

With your background of experience, I feel sure you can give me this information without going to too much trouble.

Very truly yours,
*ENGINEER*

Dear Mr Engineer,

Many factors affect the manufacturing cycle of such a complex piece of apparatus as a turbine-generator set. Variations in rating, steam conditions, generator voltage, etc result in thousands of new designs, precluding to a great extent the possibility of duplicate units. Therefore, we build in advance of an order only small parts that can be used on any turbine-generator set.

The average time needed to produce a turbine-generator set of the size you mention is just about nine months. This, of course, varies with the special features we are asked to include.

The high-pressure casing, usually a steel casting containing special materials to withstand high pressure and high temperature, is probably the most critical piece to schedule. This casting is made to suit the customer's needs, which often requires the remaking of a basic pattern or the making of a completely new pattern. When this casting arrives in our shops, we must rough-machine, magnetic-test, X-ray, chip and weld all imperfections before any finish-machining can be done.

When this major casting is completely machined, we are ready to start assembly of the turbine-generator unit. This assumes that all other parts, such as the rotor, diaphragms, oil pumps, generator, exciter, etc, have been completed in parallel with the high pressure casing. The assembly cycle for a complete set of the size you mention varies from 3 to 6 weeks.

Upon completion of assembly, the turbine and generator are placed on one of our test stands where they are given a thorough test under steam to determine their acceptability. After test has been completed, the turbine is opened for final inspection and processed for shipment. The turbine is then closed and set on flat cars along with the generator and other items of shipment.

Before any work can begin in the factory, we must have the necessary working drawings. Here the engineers and draftsmen come into the picture. The more time we can give these men to study and lay out designs, the better they are able to explore more than one way of fitting your requirements. Engineering time cannot be skimped to save time on shipment. So any delay in releasing work lengthens the time to produce a unit.

Your question on customer's changes in design and their effect on shipment is a difficult one to answer since there is so much machining to do and so many parts to assemble to complete a unit.

Our scheduled shipments are predetermined on the number of orders on hand, plus the commercial forecast for future orders. From this a monthly rate of output is established and sufficient manpower and machine tools are provided to maintain this rate.

New orders are scheduled for the months when we have available space. You can see from this that changes made in the design of a unit after receipt of order may seriously interfere with the shipment schedule. If the interference causes a rescheduling of other units, a relatively small change would result in a fairly serious delay.

I can recall one instance where a customer's request for a change in generator voltage, months after the order was placed, required the designing of a completely new generator frame with punchings and windings. This not only caused a two months' delay in shipment but we also lost a space in our manufacturing schedule since we could not bring another unit into this spot on such short notice.

Changes in size or location of a throttle valve or an extraction opening, or changes in steam conditions may result in delays just as serious as the one I described.

If you are interested in a more complete picture of our turbine-generator production and scheduling, I shall be pleased to go over it with you in more detail on my next visit.

Sincerely,
*TURBINE SPECIALIST*

# *MUDDLING* in High Places

It is time for men in Washington and London to stop toying with the problem of international trade. We of the democratic West are at a turning point in our economic affairs. A false step by either the United States or Britain could lead quickly to disintegration of trading between the people of the world as we have known it for the past hundred years. Recent meetings of diplomats in London and Washington have not lifted us out of this danger.

By two simple tests you and I can measure the sincerity of the men in Washington and in London who are trying to solve what they call "the dollar crisis."

**One test applies to the British: Is Britain making an honest effort to re-establish itself as a real competitor in world markets?**

**The other test applies to us in the United States: Are we willing to see Britain re-emerge as a strong competitor in world markets—even in our own home market—and to help her do so?**

**Today, even though both countries have faced the devaluation test, the answer to these questions probably is no.**

## I

The situation we face is, in fact, unprecedented. In every important industrial country of the non-Communist world, except Germany and Japan, production is above prewar volume, thanks largely to the Marshall Plan. Yet trade between nations is shackled as it has never been since the 18th century. And the shackles grow day by day. What is worse, two distinct trading areas—the dollar area and the sterling area—have grown up in the non-Communist world, and the gulf between them grows wider.

What kind of leadership have the United States and Britain had in the face of this crisis? President Truman late in August wisely checked the trans-Atlantic bickering over the dollar crisis. *But Mr. Truman showed no awareness of the basic question that the American people must soon decide: Is the United States able and willing to generate trade between nations, as Britain did in the 19th century?*

What have British leaders offered us? Foreign Secretary Bevin and Chancellor Cripps called their September visit to Washington "one of the most important missions in history." *But they did not tell the British people, and perhaps do not admit themselves, that their Labor government must change its internal and external policies if Britain is ever to earn its living in a competitive world.*

Admittedly, the problem Britain has faced since 1945 is a colossal one. But, in the face of its grave difficulties, what has Britain done? The working day was shortened. Welfare economics have run riot. High taxes have sapped incentives. Labor and capital have clung to their prewar psychology of cartels and featherbedding. Government controls and government trading have hamstrung private initiative. Nationalization schemes have injected politics into the struggle for industrial recovery.

Thus the policies of the Labor government have made Britain's adjustment to its new position in the world immensely more difficult. But Americans who attribute the danger of an international breakdown to British socialism greatly oversimplify the problem. Virtually every country in the world, socialist or not, faces the same dollar crisis that Britain faces.

continued on next page

We Americans must recognize that our economic strength unbalances world trade as does Britain's weakness. World War II increased America's superior power to produce goods. It also made the United States more self-sufficient. Thus, while the world demand for American goods has risen, our demand for foreign goods, except for basic raw materials, has not increased. Today we sell more to every major area of the world than we buy from it—and yet we wonder why there is a dollar crisis.

**It is time for us to recognize that there are two fundamentally conflicting pressures at work in the United States. One is our desire for a big surplus of exports over imports. The other is our desire for a system of free-wheeling trade around the world. We can not have both unless we as taxpayers wish to subsidize our exports. Which do we want?**

Curtis E. Calder, chairman of the International Relations Committee of the National Association of Manufacturers, says, "The battle of the foreign trade gap is essentially that of reconciling our urge to export our surpluses with a reluctance to accept imports in payment for them . . . The dilemma is an uncomfortable one to face."

## II

**Here, then, are the basic questions that confront men in Washington and London. Does Britain really want expanding world trade or a high-cost welfare state? Does the United States really want expanding world trade or a huge surplus of exports? So far politicians in Washington and especially in London have ducked these issues because they are political dynamite.**

If the people of Britain decide they want to regain their position as a competitive trader in expanding world markets, here are specific objectives that men in London should set for themselves:

*1. Lower government costs.* The British Treasury has asked for cuts of 5% in 1950. But a cut nearer 15% will be necessary, even if that means fewer government subsidies and health services. Enterprise will never revive nor costs come down while taxes take 40% of the British national income, including roughly 60% of business profits.

*2. Fewer government controls.* Only by removing controls and allocations (except on a few necessities) can Britain begin to return to prices fixed by competition rather than by government fiat.

*3. Stronger anti-monopoly legislation for both business and labor.* Britain needs a concerted drive against all forms of restrictive, high-cost practices. This drive should put teeth in the anti-monopoly act and supplement it with legislation to end restrictions imposed by trade unions.

*4. Less restrictive trading practices.* Britain should retreat gradually from its international barter between governments if competition is ever to have free play in international trade.

Meanwhile, if we of the United States sincerely want multilateral world trade, men in Washington must face up to four problems and hammer out workable solutions:

*1. Use of the International Monetary Fund to back a devalued pound.* In time the Fund, in which we have the controlling voice, might be used to promote convertibility of pounds into dollars.

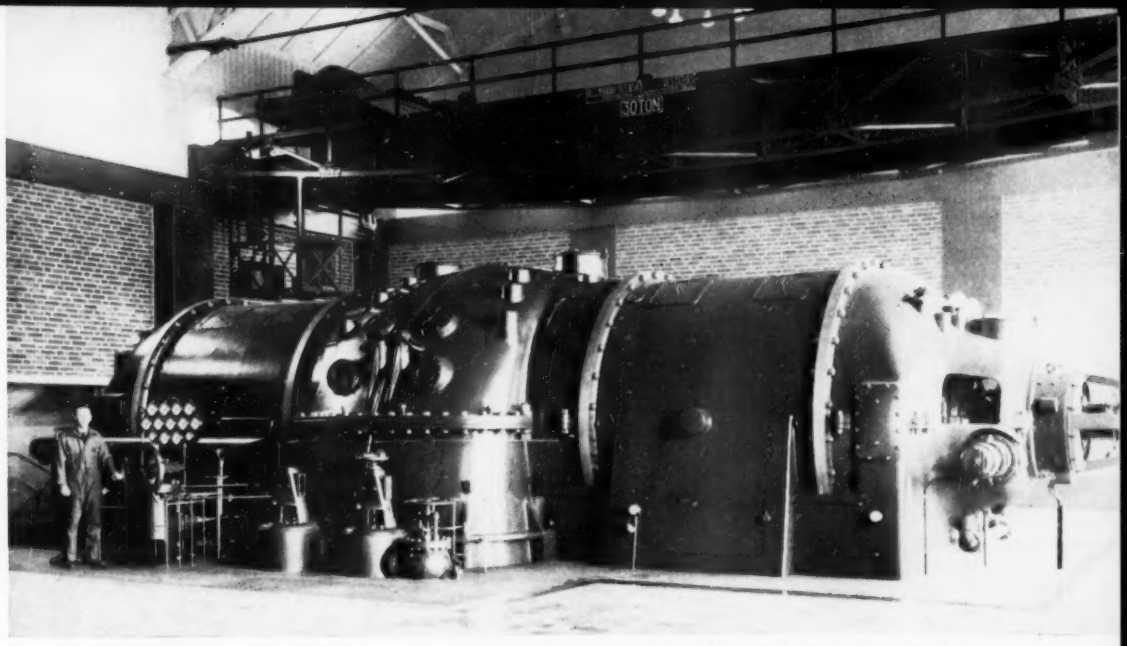
*2. Help for Britain in meeting war-created external debts.* This might mean support for London in getting a reduction of the war debts Britain owes India, Pakistan and Egypt, for example. To achieve such a debt reduction for Britain we might have to underwrite a part of a Southeast Asia recovery program.

*3. Encouragement of American investments abroad.* Such investments should be directed primarily into enterprises which will earn dollars, such as the development of new sources of raw materials, or which will raise productivity abroad.

*4. Our own tariff barriers.* Our attitude toward this critical issue will be the acid test of how deeply we believe in the merits of free world competition.

**If we really want free, competitive trading between the people of the world, these issues must be met and resolved by leaders on both sides of the Atlantic. If we do not want to face these issues, then let us resign ourselves to a world walled off into three trading areas: the Communist bloc, the sterling area, and the dollar area. So far, Washington and London have muddled along, except in facing the devaluation problem. Clarity and courage are still needed.**

*President, McGraw-Hill Publishing Company, Inc.*



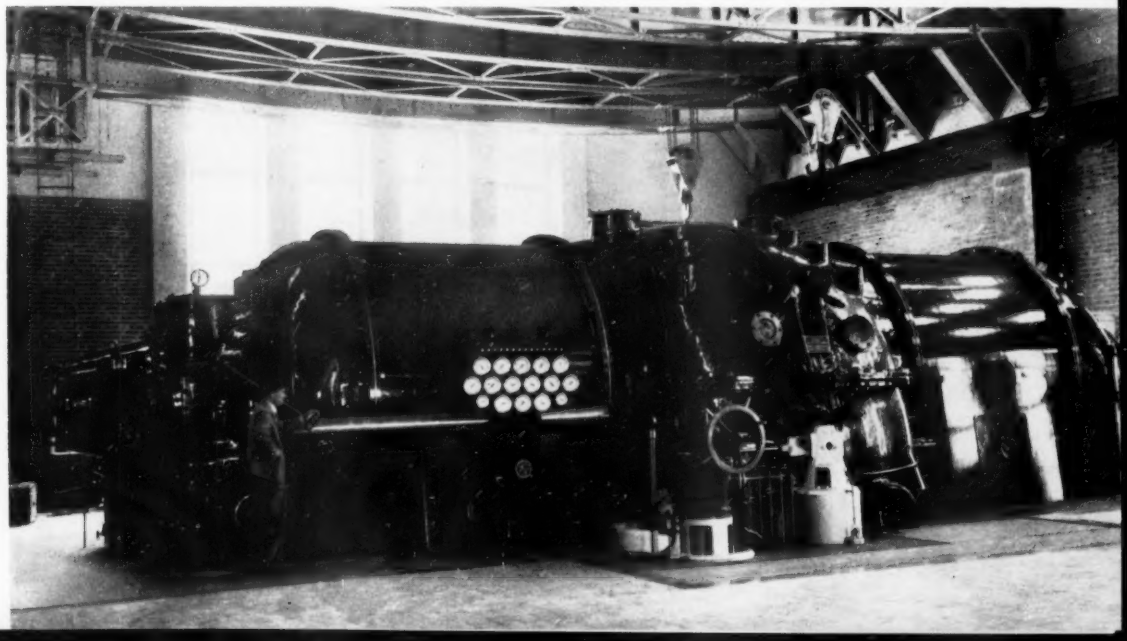
**DOUBLE-ROTATION** radial-flow reaction turbine of 50,000-kw capacity started in 1932 in State Steam Power Station, Sweden

# Condenser Supports Double-Rotation Unit

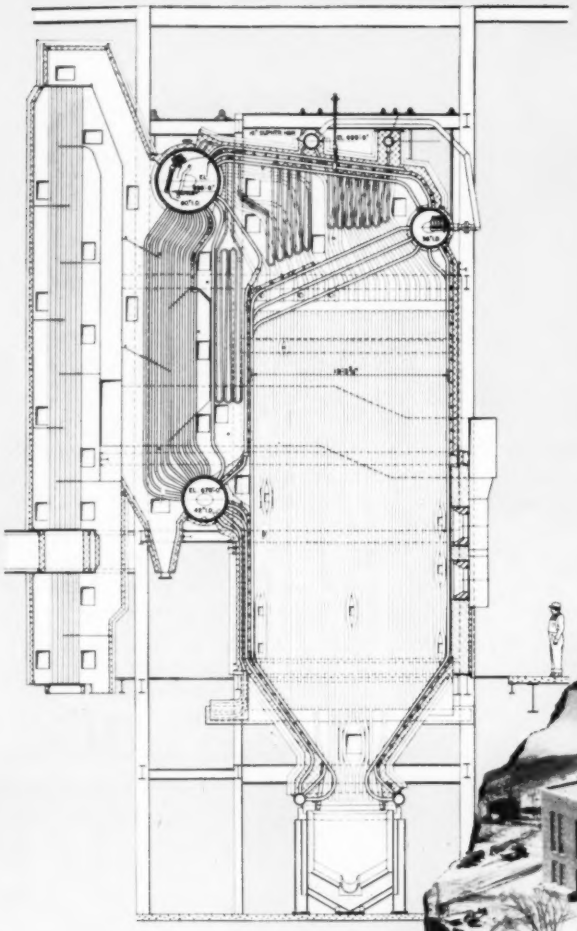
► AFTER READING about the condenser built to support its main turbine and generator in December 1948 POWER, pp 120-121, the Stal Steam Turbine Co, Ltd of Sweden s, nt us these photos. These large units are carried by their main steam condensers below, both the Ljungstrom turbine in the center and the two alternators. We are told this arrangement has been standard since 1913 for this turbine type.

All blading in these turbines are mounted on interleaving squirrel cages, which rotate in opposite directions.

**TURBINE,** rated 65,000 kw, of same design as unit above started in this station, 1949. Both units mount on main steam condenser



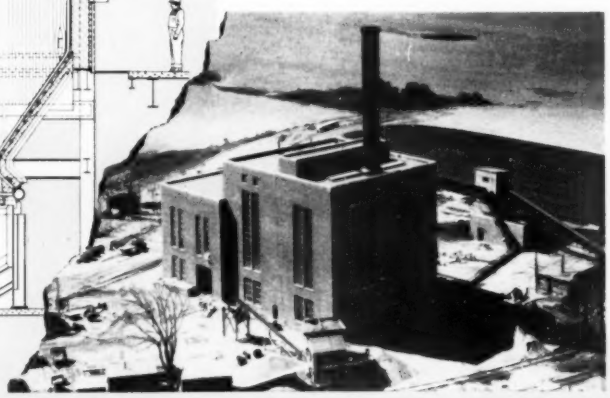
# At Interstate Power, actual results from their



**LANSING POWER STATION**
Interstate Power Company
Lansing, Iowa
Sargent & Lundy, Engineers

**TWO RILEY STEAM GENERATING UNITS**
Capacity, 120,000 lbs./hr.
Steam pressure, 975 lbs.
Steam temperature, 910°F.
Furnace volume, 8900 cu. ft.
Heat release, 17,400 B.T.U.
Heating surfaces:
Boiler, 7310 sq. ft.
Water walls, 6075 sq. ft.
Air heater, 20,800 sq. ft.

**INTERSTATE POWER COMPANY**
are installing 2–120,000 lbs./hr. Riley Steam Generating Units in their Fox Lake Station at Sherburn, Minn., and have been operating a Riley unit at their Clinton, Iowa plant since 1942.



TRADE MARK Rx REGISTERED

# RILEY

**STOKER CORPORATION, WORCESTER, MASS.**

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

# Riley Units exceed guaranteed performance

Progress of the Riley Stoker Corporation in the boiler industry—1948 was the biggest year in Riley history—can be attributed not only to the quality and outstanding performance of Riley equipment but also to the gratifying manner in which Riley handles the entire contract. Users of Riley products know that Riley gives their customers their money's worth and that you can rely on Riley to furnish units which will give entire satisfaction.

Compare actual performance with guarantees at the Lansing Power Station of Interstate Power Company. Note that exit gas temperatures are 13 degrees better than guaranteed, that efficiency is higher and draft and air pressure losses lower. Such performance is typical of what you can expect when you install Riley units.

## Comparison of Actual and Guaranteed Performance

| | Actual Results | Guaranteed Results |
|---|---|---|
| Steam output | 122,272 lbs./hr. | 120,000 lbs./hr. |
| Gas temperature | | |
| Leaving boiler | 736°F. | 765°F. |
| Leaving air heater | 362°F. | 375°F. |
| Air temperatures | | |
| Entering air heater | 107°F. | 100°F. |
| Leaving air heater | 604°F. | 600°F. |
| Steam temperature | 910°F. | 910°F. |
| Draft loss | 4.88" | 5.40" |
| Air pressure required | 5.90" | 6.50" |
| Heat balance | | |
| Efficiency | 84.56 | 84.00 |
| Losses | | |
| Dry chimney gas | 6.13 | 6.62 |
| Hyd. and moisture in fuel | 5.83 | 5.83 |
| Moisture in air | .15 | .15 |
| Unburned combustible | .53 | 1.30 |
| Ash pit water | .23 | — |
| Radiation, unaccounted for and leeway | 2.59 | 2.10 |
| | 100.00 | 100.00 |

## Investigate results from some of these recent Riley installations

NORTHERN VIRGINIA POWER CO.
Riverton Station, Winchester, Va.

CENTRAL ILLINOIS LIGHT CO.
R. S. Wallace Station, E. Peoria, Ill.

ARKANSAS POWER & LIGHT CO.
Cecil Lynch Station, Little Rock, Ark.

SOUTH CAROLINA POWER CO.
Hagood Station, Charleston, S. C.

NEW ORLEANS PUBLIC SERVICE CO.
Market St. Station, New Orleans, La.

OHIO EDISON CO.
Mad River Station, Springfield, Ohio

MISSISSIPPI POWER CO.
Plant Eaton, Hattiesburg, Miss.

IOWA-ILLINOIS GAS & ELECTRIC CO.
Riverside Station, Davenport, Iowa

CORALVILLE STATION
Iowa City, Iowa

PUBLIC SERVICE CO. OF INDIANA
Dresser Station, Terre Haute, Ind.
Edwardsport Station, Edwardsport, Ind.
Noblesville Station, Noblesville, Ind.

GULF POWER CO.
Pensacola Steam Station, Fla.

HOUSTON LIGHTING & POWER CO.
West Junction Station, Houston, Texas
Greens Bayou Station, Houston, Texas
Gable Street Station, Houston, Texas

CENTRAL OHIO LIGHT & POWER CO.
Woodcock Station, Bluffton, Ohio

OTTER TAIL POWER CO.
Kidder Station, Wahpeton, N. D.
Crookston Station, Crookston, Minn.
Devils Lake Station, Devils Lake, N. D.
Canby Station, Canby, Minn.
Hoot Lake Station, Hoot Lake, Minn.

SOUTHWESTERN PUBLIC SERVICE CO.
Borger, Texas

PENNSYLVANIA ELECTRIC CO.
Williamsburg, Pa.

UTAH POWER & LIGHT CO.
Orem Station, Provo, Utah
Jordan Station, Salt Lake City, Utah

WORCESTER COUNTY ELECTRIC CO.
Webster St. Station, Worcester, Mass.

WEST PENN POWER CO.
Milesburg Station, Milesburg, Pa.

LYNN GAS & ELECTRIC CO.
Lynn, Mass.

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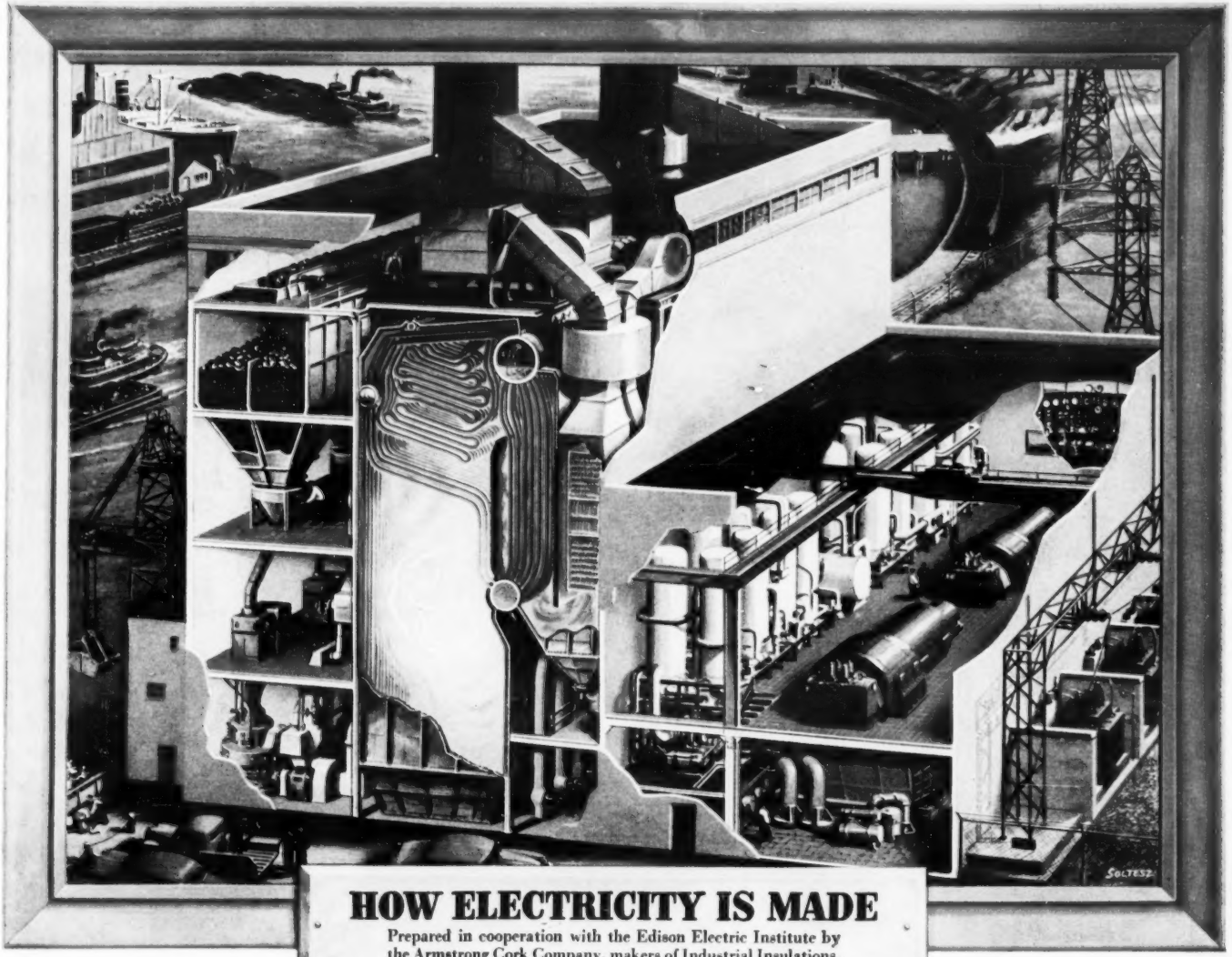



# HOW ELECTRICITY IS MADE

Prepared in cooperation with the Edison Electric Institute by
the Armstrong Cork Company, makers of Industrial Insulations.

# Power—Keystone of Modern Civilization

THE TYPICAL STEAM-ELECTRIC STATION pictured on the facing page is a colorful symbol of great achievements. So let us pause for a moment to consider broadly what the engineer has done for power and what power has done for the nation.

First, we see in the closeup an amazing chemical-process plant. Fuel is mined, transported, stored, conveyed, pulverized and oxidized to release its locked-up energy as sensible heat. This heat transforms water into very hot high-pressure steam, which expands through spinning turbine blades to deliver mechanical horsepower. This, again, is converted into electricity for distribution to millions of consumers over a vast network of slim copper wires.

Next, we see in today's power plants the miracle of great size—colossal boiler units that burn 57 tons of coal per hour, with 600 tons of air, to evaporate 650 tons of water. We also see single turbine units generating 200,000 kilowatts and single steam power plants larger than a million horsepower.

Even more important, and more difficult to achieve, has been the constant advance in thermal efficiency. Twenty years ago the average American central station burned 1.7 lb of coal per kilowatt-hour sent out. Today's average coal consumption is 1.3 lb, and stations under construction will make it for 0.75 lb.

Then, too, there is the miracle of "dirt cheap" electrical energy, of kilowatt-hours that sell for less today—to every class of consumer—than they did 20 years ago. And this in the face of staggering increases in the unit cost of power plants, fuel and labor.

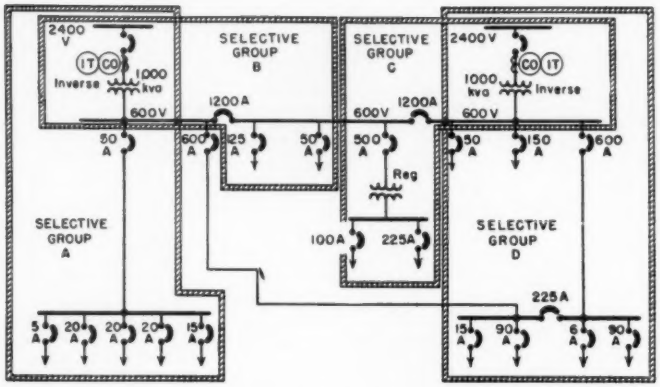
How is it possible? Because aggressive power engineering, with the full support of farsighted management, has vastly increased the productivity of power fuels, of power equipment and of power-plant labor. In 20 years average kilowatt-hour output is up 30% per lb of fuel, 66% per kilowatt of capacity and several hundred percent per man-hour of plant operating force.

Finally, for these reasons, and because Americans are well sold on the use of power, we have the economic miracle. We spend about 2% of the national income to buy the entire output of all the central stations. In 1948 this bought 240 billion kilowatt-hours. Allowing for lighting and other non-motor uses, and for generation by industrial power plants, roughly 150 billion kwhr did mechanical work in 1948.

Since one kilowatt supplied to a motor will outpace ten hard-working hand laborers, these kilowatt-hours accomplish more than 500 million slaves working ten hours a day for 300 days with hand tools.

These figures are the true explanation of America's living standards. The engineer does not exaggerate when he views his power plant as the keystone of modern civilization.

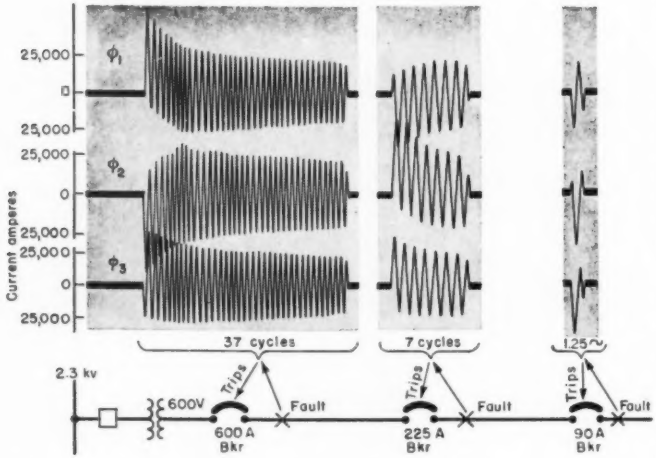
*Picture on facing page, enlarged to 21x22 in. in full color, suitable for framing, may be obtained on request.*




**1** Single-line diagram of 600-v 60-cycle auxiliary feeds. System is zoned into the selective tripping areas; trip characteristics of breakers shown in Fig. 3 and 4

# Here's How Circuit Breakers Should Trip

**Selective tripping of circuit breakers has been the standard practice with power companies where high-voltage equipment is involved. Now the art is extended to the low-voltage air circuit-breaker field for handling power-station auxiliaries***




**2** Laboratory oscillograph tests show the results of maximum short-circuit current faults. Note relationship between location of fault and breakers in the circuit

► SELECTIVE TRIPPING of circuit breakers means selecting the breaker next to the fault as the preferred breaker to open. And if this breaker fails, each of the remaining breakers in the series is set to trip progressively till the fault is cleared. In a nutshell, this means staggering the time delay of each circuit breaker's tripping element.

Up to the present time selective tripping has not been practiced widely in low-voltage power station auxiliaries. It certainly was not because power station operators do not realize the need, but rather because the proper equipment is not available to do the job.

**Circuit-Breaker Development.** Before 1936 the carbon-tip-brush contact type of breaker was in general use. This breaker had an oil dashpot overload element that operated on fault currents. But under high-current flow there was no appreciable time delay in tripping. It was not this feature that led to the next step in design but rather the need for breakers that could be metal enclosed and yet handle higher fault currents. This led to the development of the main butt contact and improvements in arc chutes and arcing tips that greatly increased the rupturing capacity of the breakers.

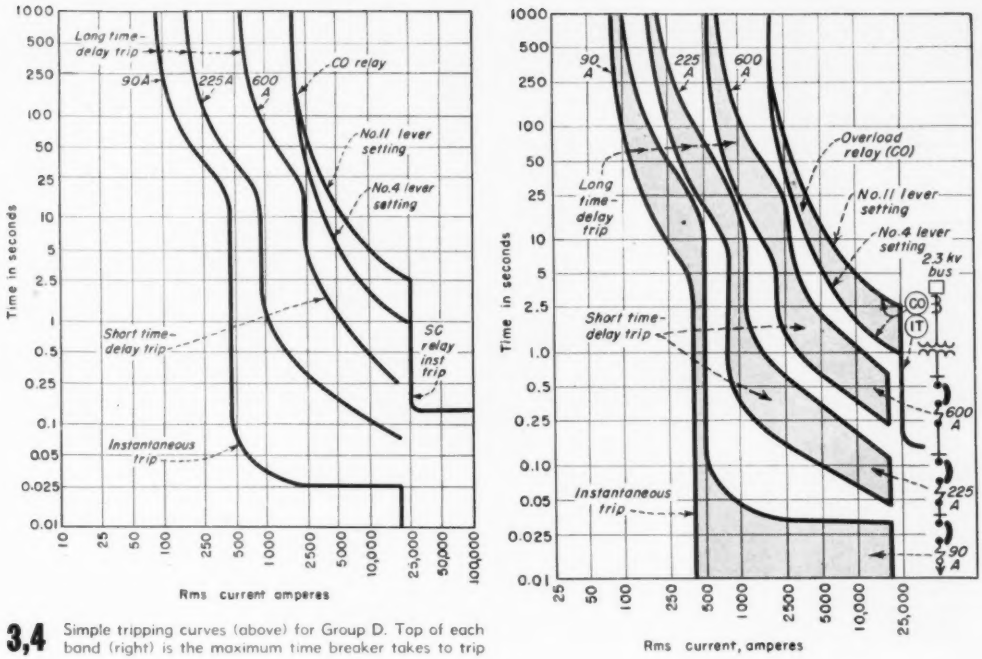
Most of these breakers depended on fast tripping, 1½ to 5 cycles, to maintain their full interrupting rating. This certainly did not fit into the selective tripping picture, which at that time meant induction-time delay relays with current transformers and dc shunt trip coils.

Aboard ship during the war, the need was keenly felt for a system of circuit-breaker tripping that would insure maximum continuity of service during battle when electrical faults were most likely to occur. To handle this need the "ticker" or escapement restraint was added to the trip bar.

**Modern Trip Units.** It was found that each trip unit on each pole of a 3-phase breaker should have its own trip device and not a restraint on the trip bar common to all breakers. The reason for this is that the force on the trip bar for 1- and 3-phase faults differs. This results in different restraint times for the two types of fault.

Time-delay features are divided into three categories; long time delay, short time delay and instantaneous. Fig. 3 and 4 show the relationship between current-time characteristics. From these curves it can be seen that a series connection of breakers equipped with time-governer trip devices will open selectively to isolate a fault.

* Based on paper, by J M Geiger of Buffalo Niagara Electric Corp and L L Fountain of Westinghouse Electric Corp, on "Selective Tripping of Low-Voltage Air Circuit Breakers for Power Station Auxiliaries." Paper was presented at Summer General Meeting of the AIEE at Swampscott, Mass., June 29, 1949.




**3,4** Simple tripping curves (above) for Group D. Top of each band (right) is the maximum time breaker takes to trip

**Typical Application.** Single-line diagram of a 600-v 60-cycle auxiliary system equipped with selectively tripped air circuit breakers is shown in Fig. 1. There are no breakers in the transformer secondary leads. Hence, induction disk overcurrent relays, protecting the 2.3-kv primary breaker, have been included in the selective tripping scheme.

These overcurrent relays act as backup protection for the entire 600-v system, as well as protection against transformer faults. Relay setting is such that it will operate after a time delay for faults on the 600-v system. This time delay is sufficient to allow for normal clearing of 600-v system faults by the proper low-voltage air circuit breaker. If they fail to open in the predetermined time the induction relay on the 2.3-kv breaker will swing into action.

**Tripping Groups.** Four selective tripping groups in Fig. 1 have been roped off in the diagram and designated as groups A, B, C, D. Within each of these groups the breakers are selective to one another. In case of a fault the breaker closest to the fault will trip. Any parallel circuits will be left intact carrying load.

Since group *D* in this setup has the most breakers let's look at it in detail. The first in this string of breakers is the 2.3-kv primary breaker, under the tripping control of the overload induction relay. Second is the 600-amp breaker leading to the third in our sequence, the 225-amp bus tie breaker. For the fourth we'll pin our remarks down to the 90-amp breaker.

**Characteristic Curves.** The current-time characteristic curves for the induction relay and the three breakers are shown in Fig. 3. These are average characteristic curves showing complete selectivity from simple overloads to short-circuit currents up to 20,000-amp rms. Now in Fig. 4 the current-time curves have been changed to so-called band curves. Both Fig. 3 and 4, together with the single line diagram in Fig. 1, show the relationship between the breakers in the circuit and their tripping characteristics.

Now here's the story on the band curves, Fig. 4. Any fault that remains on long enough to reach the lower end of the band curve causes the breaker to trip whether or not the fault current is interrupted by some other breaker below it. In other words, this is a limit beyond which the breaker will trip because of inertia of parts and opening of latches. Now the top part of the band curve is the maximum time the breaker should take to trip under any condition. The factors that cause this upper limit are manufacturing tolerances, temperature effects and mechanical friction variances that are a function of maintenance.

Fig. 2 shows the oscillograph results of short-circuit currents in Group *D* with their relation to location of faults and breakers in the circuit. This was a laboratory test but field tests covering breakers in all four groups gave results falling within the limits in Fig. 4.

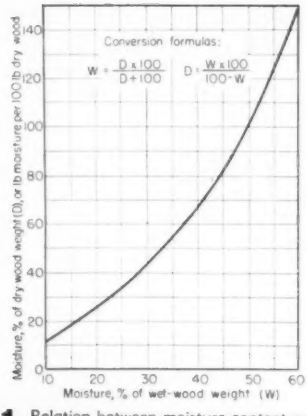
**Cascading.** Let's round out our picture by a few words on the cascade method of circuit breaking. Breakers are hooked in cascade to reduce the first cost of switching and protective equipment. With the cascade arrangement the breaker nearest the source of power has ample interrupting capacity for the load. But the circuit breakers closer to the load are applied beyond their rated interrupting capacities.

To protect the circuit breakers used beyond their rating, the breakers in the series are tripped instantaneously as the short-circuit current approaches interrupted rating of the overloaded breakers. With the cascade arrangement it's quite possible for two or all three breakers to open if the fault current is severe. Since the smaller circuit breakers are backed up by those with a higher interrupting rating their life depends on the backup circuit breakers opening simultaneously with them.

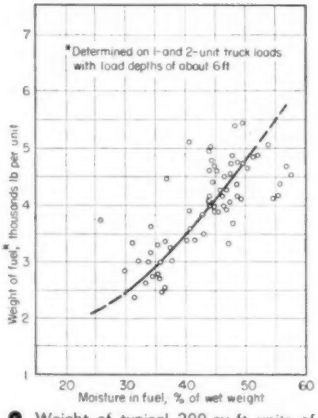
# Handy Charts Simplify Wood-Fuel

**Putting information together from scattered sources and setting it up in convenient form saves time in checking plant operation. Use the charts as prepared or as models for your own**

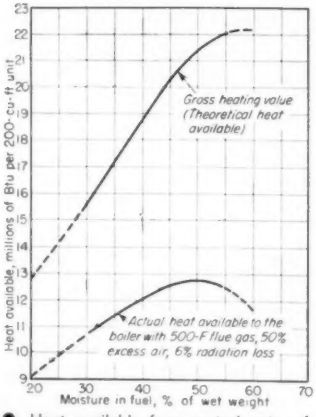
By **DELMAR L BROWN**
*Superintendent, Testing Dept*
*Portland General Electric Co*


Conversion formulas:
W = D x 100 / D + 100
D = W x 100 / 100 - W
Moisture, % of dry wood weight (D), or lb moisture per 100 lb dry wood
Moisture, % of wet-wood weight (W)

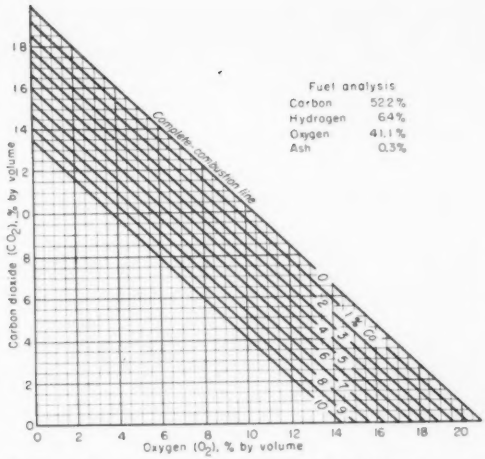
**1** Relation between moisture content on dry-wood basis and on wet-wood basis


*Determined on 1- and 2-unit truck loads with load depths of about 6 ft
Weight of fuel,* thousands lb per unit
Moisture in fuel, % of wet weight

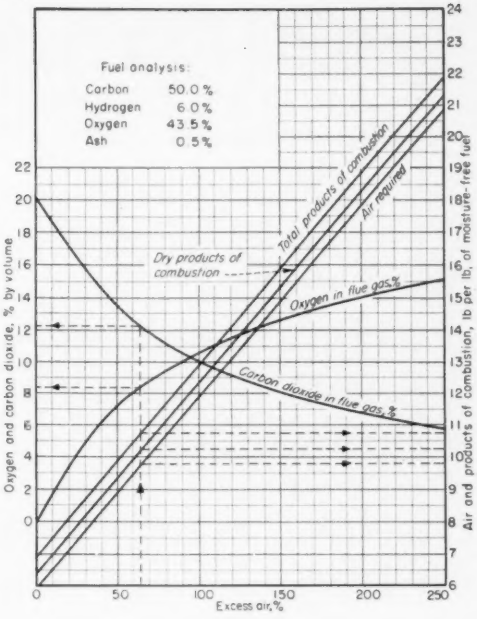
**2** Weight of typical 200-cu-ft units of Douglas-fir hogged fuel and sawdust


Gross heating value (Theoretical heat available)
Actual heat available to the boiler with 500-F flue gas, 50% excess air, 6% radiation loss
Heat available, millions of Btu per 200-cu-ft unit
Moisture in fuel, % of wet weight

**3** Heat available from typical units of fir hogged fuel, based on Chart No. 2




**4** Chart for typical fir wood fuel permits checking the consistency of flue-gas analyses by orsat or similar methods




**5** Combustion characteristics of wood fuel: air required and products of combustion plotted against percent excess air

# Combustion Checks

► INFORMATION on the properties of wood waste as a fuel is likely to be obtained from widely scattered sources and in inconvenient form. To save time in checking our operations and making combustion calculations, we put together a set of charts that answer many questions, Fig. 1-9.

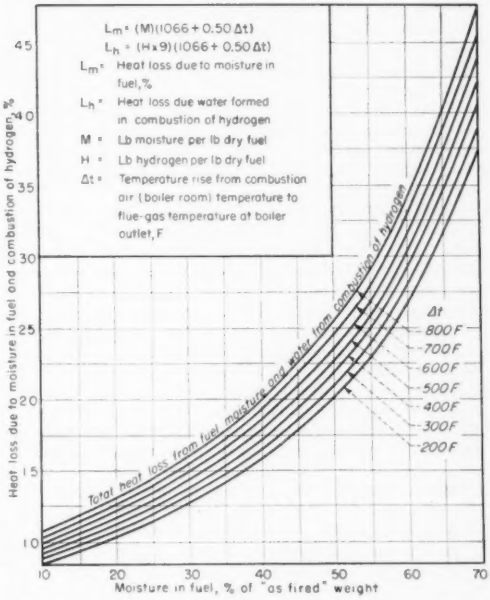
These are based on typical Douglas-fir wood wastes as widely used in the Pacific Northwest. With exceptions noted, they serve for rough calculations where other types of wood and vegetable fuels are burned. For accurate work, similar data can be plotted using properties of fuel selected.

**Moisture in Wood.** This may be expressed as a percentage of dry-wood weight (lumber standard) or wet-wood weight (fuel standard). Fig. 1 shows relation between these two values.

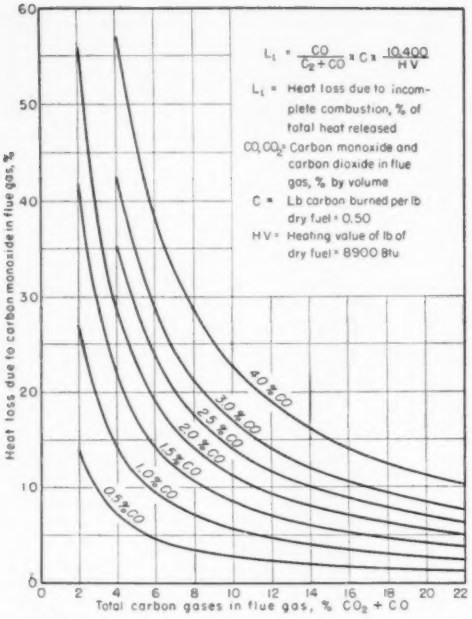
Hogged fuel and sawdust are often measured in *units*—a unit being 200 cu ft. Fig. 2 gives weights of typical units for different moisture contents, as determined on 1-unit and 2-unit truck loads, with load depths of about 6 ft. The curve shows median values. Data serve for other species than Douglas fir, but not for dry shavings.

Based on the median curve of fuel weight vs moisture, Fig. 3 gives theoretical and actual heat available with different moisture percentages. Higher heat values for moisture percentages up to 50% result from packing of wet wood, which gives greatly increased wood substance per cu ft. Data should not be taken to mean that fuel should be wetted after purchase.

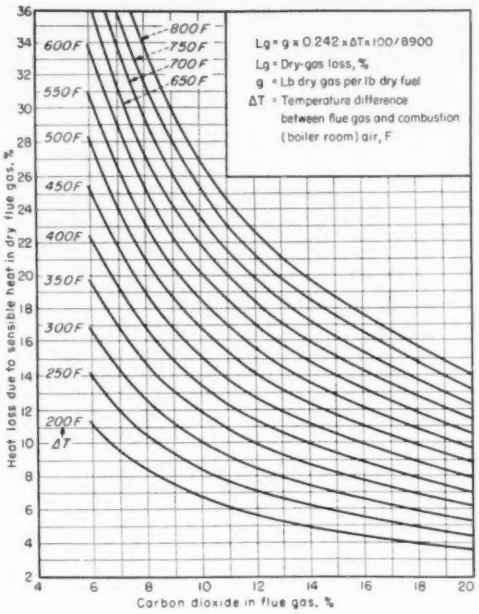
**Flue Gas.** Fig. 4 is the familiar flue-gas checking chart, based on a typical fir-wood fuel. To check an analysis, start with either the $CO_2$ reading or the $O_2$ reading. Let's say we


$L_m$ = (M)(1066 + 0.50 Δt)
$L_h$ = (H x 9)(1066 + 0.50 Δt)
$L_m$ = Heat loss due to moisture in fuel,%
$L_h$ = Heat loss due water formed in combustion of hydrogen
M = Lb moisture per lb dry fuel
H = Lb hydrogen per lb dry fuel
Δt = Temperature rise from combustion air (boiler room) temperature to flue-gas temperature at boiler outlet, F
Total heat loss from fuel moisture and water from combustion of hydrogen
Δt
800 F
700 F
600 F
500 F
400 F
300 F
200 F
Heat loss due to moisture in fuel and combustion of hydrogen, %
Moisture in fuel, % of "as fired" weight

**6** Total heat loss from moisture in fuel and water resulting from combustion of hydrogen, plotted against percent moisture for a range of temperature rise from 200 to 800 F.


$L_l = \frac{CO}{C_2+CO} \times C \times \frac{10,400}{HV}$
$L_l$ = Heat loss due to incomplete combustion, % of total heat released
CO, $CO_2$ = Carbon monoxide and carbon dioxide in flue gas, % by volume
C = Lb carbon burned per lb dry fuel = 0.50
HV = Heating value of lb of dry fuel = 8900 Btu
4.0 % CO
3.0 % CO
2.5 % CO
2.0 % CO
1.5 % CO
1.0 % CO
0.5 % CO
Heat loss due to carbon monoxide in flue gas, %
Total carbon gases in flue gas, % $CO_2$ + CO

**7** Chart gives heat loss from incomplete combustion of wood fuel when percent CO, and $CO_2$ + CO, are known by analysis




**8** Knowing percent $CO_2$ in flue gas, and gas-temperature rise, loss due to sensible heat in dry flue gas can be found

enter the chart with the $CO_2$ reading and move across to the CO value found by analysis. Moving down, we pick off an $O_2$ figure. If it agrees with the $O_2$ found by analysis, all is well; if it doesn't, the analysis is "off" somewhere. Chart can also be used to estimate CO when only $CO_2$ and $O_2$ have been determined.

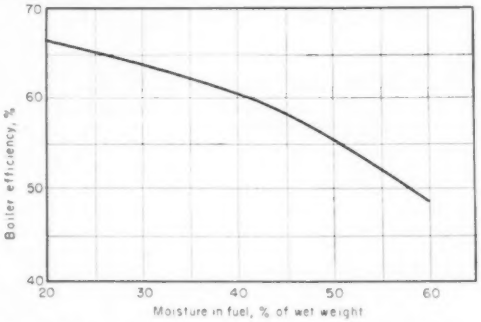
For a typical wood fuel, Fig. 5 shows total air needs for a given excess-air percentage, and what the combustion products will be—percent by volume of $CO_2$ and $O_2$ in the flue gas, total and dry products of combustion in lb per lb of *moisture-free* fuel.

**Heat Losses.** Fig. 6-8 yield values for three major heat losses: (1) loss due to moisture in fuel, and water formed when fuel's hydrogen burns (2) loss from incomplete combustion, and (3) loss due to sensible heat in dry flue gas. Total loss is the sum of these three losses and an additional estimated loss for radiation, usually 4 to 10%. Boiler efficiency is 100% minus the total loss in percent.

Loss due to moisture in the fuel varies with percentage of moisture and temperature rise from boiler room to boiler outlet. For any particular fuel, loss due to water resulting from burning of hydrogen varies only with temperature. These latter values are not separated in Fig. 6. Curves in the figure show the sum of these two forms of moisture loss, in percent, for a range of temperature rise.

In Fig. 7, percent heat loss from incomplete combustion is plotted against $CO_2$ plus CO, for a range of temperature rise. Heating value of dry fuel is taken as 8900 Btu per lb.

The flue gas going up the stack carries heat with it. Amount of loss depends on gas temperature rise and quantity. Quantity, in turn, depends on percentage of excess air, as indicated by $CO_2$ in flue gas when combustion is complete. Thus Fig. 8 consists of a family of curves for a range of temperature rise, plotted against percent $CO_2$.




**9** Marked effect of increased fuel moisture content on overall boiler efficiency is shown clearly in a typical curve. This assumes that all other combustion factors stay constant

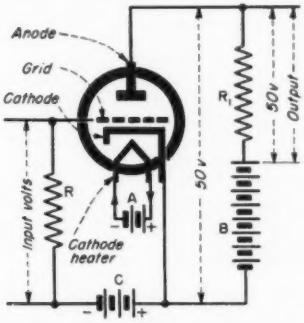
It is interesting to note that the gas-composition and heat-loss charts remain accurate even if samples are taken on intermittently fed furnaces that may be burning "wood" or "charcoal" at the time of gas sampling. This is because both wood and carbon produce a dry-basis flue gas of the same composition.

Fig. 9 shows that "efficiency," as now defined, is not solely a function of the performance of the boiler when wood is the fuel. It is greatly affected by fuel moisture, making it incorrect to compare performance of boilers burning fuels of widely different moisture contents.

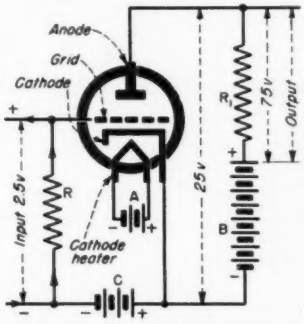
# ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

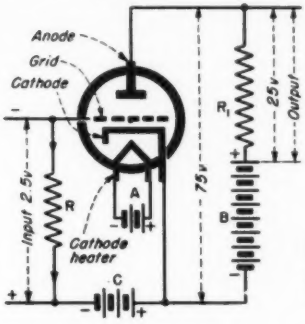
## Single-Stage Amplifier Circuits



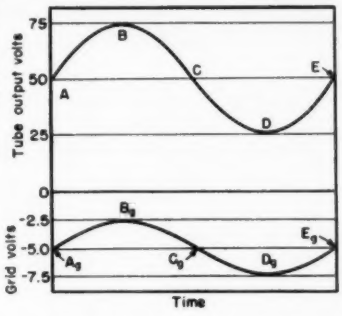

**1** Simple single-stage amplifier. Battery C applies a 5-v bias to the grid




**2** Same as Fig. 1 but the input signal decreases the bias on grid to –2.5 v




**3** Same as Fig. 2 but input signal has been reversed to increase grid bias




**4** Curves show how tube's output volts follow changes in bias on the grid

# 19—One- and Two-Stage Amplifiers

► DURING OUR STUDY of relays we gave little thought to the kind of signal that acted on the amplifying tube. Here we will study how the input signal to the amplifier is reproduced in the output circuit. This signal may be (1) a very-low-voltage 60-cycle ac wave (2) a sound wave transmitted electrically (3) a slight change in voltage because of a small variation in speed (4) a voltage change caused by a resistance change due to an increase or decrease in temperature, or (5) any other of several signals of a changed condition. In an electronic measuring device, one part converts the quantity to be measured into a minute current or voltage that can be amplified into a measurable quantity.

Amplifying the signal to a usable quantity may be done in one, two, three or more stages. Here we will study single- and 2-stage amplification. If the input signal is very weak three or more stages of amplification may be required to obtain a usable quantity in the output circuit. In most industrial electronic applications single- or 2-stage amplification does the job.

**Single-Stage Amplifier.** Fig. 1 shows the circuits for a single-stage amplifier. Assume the grid has a minus bias of 5 v, and power battery *B* applies 100 v across the amplifying tube and resistor $R_1$. With a minus bias of 5 v on the grid assume there is 50-v drop across the tube, and 50 across $R_1$. To simplify our study of these circuits we will omit any consideration of current flow in them.

In Fig. 2 assume a dc signal of 2.5 v of the polarity shown is applied to grid resistor *R*. This voltage causes current to flow through the resistor that produces a 2.5-v drop across it. Drop across R opposes battery *C* volts and reduces the grid bias to –2.5 v. Under this condition assume that voltage across the tube drops to 25 v, while across $R_1$ it increases to 75 v.

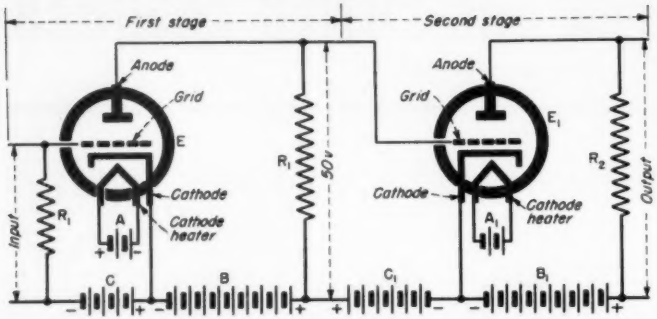
**Signal Reverses.** As a third condition assume that polarity of the 2.5-v signal reverses, as in Fig. 3. The signal 2.5 v is now in series with battery *C* to increase the grid bias to –7.5 v. For this condition assume voltage across the tube increases to 75 v and drops to 25 v across $R_1$.

In Fig. 1 to 3 we see that when minus bias on the grid decreased, volts across resistor $R_1$ increased, and when grid bias increased, volts across $R_1$ decreased. Voltage across $R_1$ represents the useful output of the tube. Changing the grid bias from –2.5 to –7.5 v, volts drop across resistor $R_1$ decreased from 75 to 25 v, or a change of 50 v.

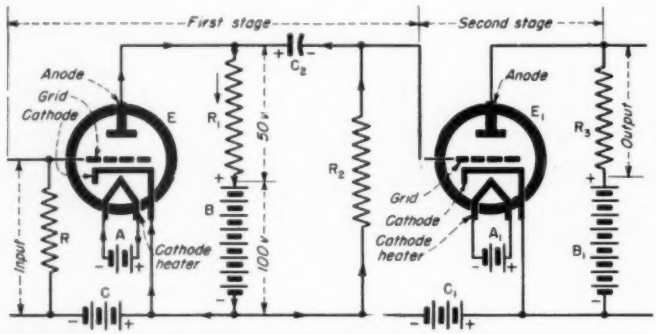
Conditions in Fig. 1 to 3 may be represented as in Fig. 4. The vertical scale represents grid and output volts, and the horizontal scale, time. With dc on the grid, its volts are constant so –2.5 or –5 v can be represented by a straight line running to the right from these values. Likewise, output volts can be represented by straight lines running to the right from the different values.

**AC Signals.** Assume that instead of the grid input being dc, it is ac with a maximum value of 2.5 v. In Fig. 1 with –5 v on the grid we have 50-v output across the load. Assume that the input signal in Fig. 2 is an ac wave that increases from zero to a maximum

## Two-Stage Amplifier Circuits




**5** Circuit diagrams for a simple 2-stage direct-resistance-coupled amplifier. The two parts of this diagram are similar to the single-stage amplifier, Fig. 1




**6** Circuit diagram for a 2-stage resistance-capacitor-coupled amplifier. This is another commonly used electronic circuit where high amplification is needed

of +2.5 v. Then, the minus bias of –5 v applied to the grid gradually decreases to –2.5 v, and can be represented by the curve $A_eB_e$ in Fig. 4.

While the minus bias on the grid has decreased, output volts have increased. Consequently when the grid has a bias of –2.5 v, output volts have increased to 75 v, curve *AB*.

After grid input reaches –2.5 v it returns to zero, as indicated by curve $B_eC_e$. The grid again has a bias of –5 v and output volts return to 50, curve *BC*.

The grid input being ac reverses when it returns to zero at $C_e$ and the grid has a bias of –5 v. At the curve's maximum value $D_e$, the grid has a –7.5 v bias, as in Fig. 3. Output volts, therefore, fall to 25 v, curve *CD*. As the signal volts return to zero at $E_e$ output volts again increase to 50 v at *E*.

Several points in these operations should be noted. Grid bias –5 v, Fig. 4, corresponds to zero line for the ac input volts. The wave above this line has positive direction, while below it has negative. The ac input volts are superimposed on battery *C* dc volts to decrease or increase the grid bias, depending on whether the ac wave is positive or negative. When it is positive the grid becomes less negative, and when negative the grid bias increases, as shown in Fig. 4.

Output volts' change from 50 to 75, and back to 50, is an amplification of the change in grid ac input volts. But even though the grid input volts are alternating this is not true of the output voltage curve, which is still dc in one direction, varying in value as the grid input volts vary in value and direction.

**Volts Across Tube.** As shown in Fig. 1 to 3 when output volts vary, volts across the tube change inversely. That is, when volts' drop across the tube was 25, Fig. 2, output volts were 75, and when voltage across the tube increased to 75, Fig. 3, output was 25. For every condition, the two total that across battery *B*, or 100 v.

The tube when acting as an amplifier can supply only an output voltage less than that of the power source, in this case battery *B* volts, minus the drop across the tube. In this respect the tube acts as a variable resistor in series with $R_1$. If we decrease the variable resistor, voltage across it decreases and increases across $R_1$. Conversely, increasing the variable resistor increases the volts' drop across it and decreases voltage across $R_1$.

Voltage wave *ABCDE*, Fig. 4, is the useful output of the amplifier. It is an amplified reproduction of the signal volts applied to the grid. When the output voltage is too weak to actuate the desired control, further amplification is necessary.

For example, assume that the input signal, Fig. 4, varies + or –0.25 v, and that the output changes through a range of 5 v instead of 50. We can then use this voltage on the grid of a second-stage tube to obtain a higher output voltage.

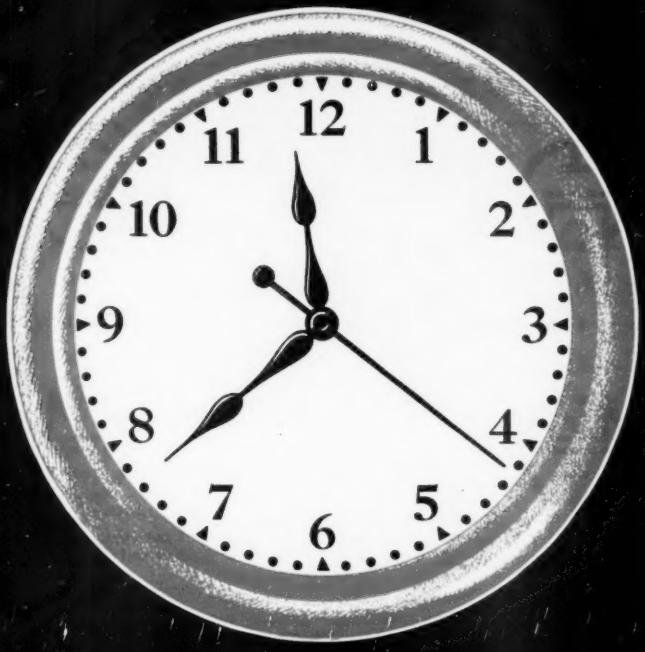
**Two-Stage Amplifier.** Fig. 5 shows one method of doing this by what is known as a direct resistance-coupled 2-stage amplifier in simplified form. In later articles we will have an opportunity to study this amplifier in commercial circuits. The two halves of this diagram are similar to the single-stage amplifier, Fig. 1 to 3.

Assume, with –5 v bias, or the first stage, that tube *E* passes enough current from battery *B* to cause 50-v drop across resistor $R_1$ as indicated. This voltage is applied from grid to cathode of second-stage tube. If we want a –5 v bias on this tube we can apply a positive potential of 45 v from battery $C_1$. This potential acts from its – terminal to the cathode and grid through $R_1$, back to $C_1$ + terminal.

The 50 v across $R_1$ acts from the grid to cathode through $C_1$ to + terminal of battery *B*. Since the two potentials oppose, their difference 50 – 45 = 5 v is applied as a minus bias on the grid of tube $E_1$. Other conditions being comparable to the first stage, tube $E_1$ will pass sufficient current from $B_1$ to cause 50-v drop across $R_3$, the output circuit.

Assume that from the input circuit a bias of 0.25 v is applied to the grid, as in Fig. 2. This gives the grid a minus bias of 5 – 0.25 = 4.75 v, and the tube's current increases to where voltage across $R_1$ is 50 + 2.5 = 52.5 v, assuming a 10 to 1 gain from input to output. The grid of tube $E_1$ now has a minus bias 52.5 – 45 = 7.5 v. For a gain of 10, output voltage decreases to 50 – 25 = 25 v. Across the two stages the gain has been from 0.25 v to 25, or 100 times.

If the input voltage on the grid of tube *E* is reversed as in Fig. 3, grid bias becomes 5 + 0.25 = 5.25 v. Then output voltage decreases to 50 – 2.5 = 47.5 v. Tube $E_1$ grid now has



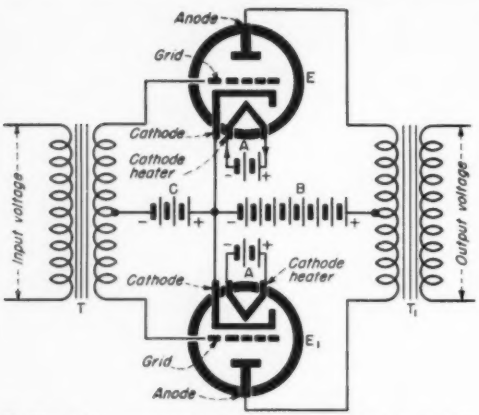

# AS REGULAR AS CLOCKWORK

The smooth, clockwork regularity with which one dust valve closes and another instantaneously opens in Automatic Hydrovac results in greater efficiency, saves time and power, and reduces maintenance, particularly on piping. Automatic sequence opening and closing of the dust valves assures the full-capacity operation necessary for getting maximum work from the entire system. The system practically thinks and runs by itself—skipping over boilers not in use, warning of unusual conditions, keeping the attendant informed of all operations, and automatically shutting down when its job is done. Our nearest representative can tell you how cost-saving, Automatic Hydrovac pays for itself sooner than you think. Write us.

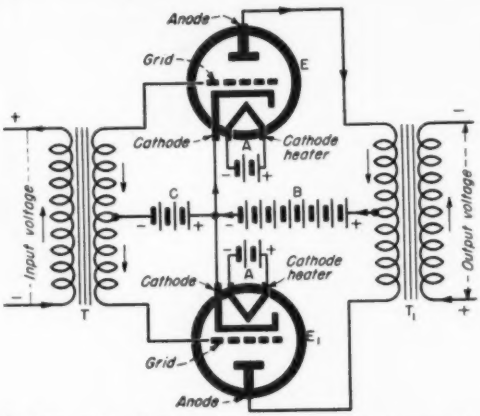
## HYDROVAC *Dust Handling*

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. *Offices & Representatives in Principal Cities*

## Push-Pull Amplifier Circuits for High Current




**7** Two tubes, connected in a push-pull amplifier for a large power output in industrial circuits, often use thyratrons




**8** Same as Fig. 7 but input circuit is energized to cause the tube E to conduct and supply power to output transformer

a minus bias of 47.5 − 45 = 2.5 v, and output voltage increases to 50 + 25 = 75 v, the same as in Fig. 3. If an ac bias of 0.25 maximum is applied to tube $E$, output of tubes $E$ and $E_1$ will vary like the output volts, which appear in the upper part of Fig. 4 and are explained in the operation of Fig. 2 and 3.

Operation of a direct-resistance coupled amplifier is simple. It can be used on dc or ac circuits, but it may be unstable. Cathode-heating, grid and anode volts are not likely to remain constant for long periods. These changes, when they occur in tube $E$ circuits, are amplified and passed along to tube $E_1$, where they may be further amplified to an objectionable amount. But because it amplifies dc signals, the direct-resistance-coupled 2-stage amplifier is frequently used in industrial-control applications.

**Capacitor-Coupled Amplifier.** A resistance - capacitor - coupled amplifier, Fig. 6, is another commonly used circuit. In this design a capacitor $C_2$ couples output voltage of first-stage tube $E$ to the grid of second-stage tube $E_1$. This hookup can be used to amplify ac signals only because a capacitor cannot pass dc. A study of Fig. 6 shows why this is so, and how the amplifier works.

Assume the conditions of Fig. 1 where we have a −5 v bias on the grid, and tube $E$ passes sufficient current to cause 50-v drop across resistor $R_1$, the output voltage. Arrowheads indicate current flow. For an instant, current flows from battery $B$ − terminal up through resistor $R_2$, capacitor $C_2$, resistor $R_1$ to battery $B$ + terminal.

When conditions become normal there is 50-v drop across resistor $R_1$. This acts as a 50-v battery connected in the circuit opposite to battery $B$. The effective volts across capacitor $C_2$ are then 100 − 50 = 50 v, to which it is charged. As long as conditions remain constant capacitor $C_2$ remains charged at 50 v to the polarity shown and no current flows through it.

Because current does not flow through resistor $R_2$, 5-v battery $C_1$ puts a 5-v bias on the grid of tube $E_1$. Other conditions being equal, 50 v appears across output resistor $R_3$. Assume an ac voltage of maximum 0.25 v applied to the grid as in Fig. 2 and represented by the curve $A_2B_2$, Fig. 4. This decreases the bias on the grid of tube $E$, and increases the output voltage across $R_1$.

At the instant that the ac bias reaches its maximum, output voltage is 50 + 2.5 = 52.5 v. The voltage across capacitor $C_2$ is now 100 − 52.5 = 47.5 v. The charge in it will be changed accordingly by a current flowing from minus of $C_2$ through $R_2$ and tube $E$ to its plus side. This change of charge in $C_2$ takes place while the bias on the grid is increasing so the current flowing out of $C_2$ is an amplified reproduction of the wave applied to the grid of tube $E$.

Voltage drop across $R_2$ is also a wave that increases from zero to a maximum of 2.5 v that increases the minus bias on the grid of tube $E_1$. Consequently, output voltage of $E_1$ decreases as a wave to a maximum of 25 v, as curve $CD$, Fig. 4. After the input to tube $E$ grid reaches a maximum it decreases to zero curve $B_2C_2$, Fig. 4. While this is happening, capacitor $C_2$ returns to a charge of 50 v, and output voltage of tube $E$ returns to 50 v, curve $DE$, Fig. 4.

When the input voltage reverses on the grid of tube $E$, curve $C_2D_2E_2$, Fig. 4, output voltage across $R_1$ decreases to 50 − 2.5 = 47.5 v. But the capacitor is charged to only 50 v. Current then flows from − on battery $B$ up through resistor $R_2$ through the capacitor down to + on the battery. At the voltage wave's maximum, the capacitor is charged to 52.5 v. Current flows up through resistor $R_2$, causes a voltage drop that opposes the voltage of battery $C_1$, and the bias on tube $E_1$ grid decreases accordingly. Current flow first increases in a wave through the tube to produce a maximum output voltage increase of 25 v and then returns to a normal of 50 v, curve $ABC$, Fig. 4.

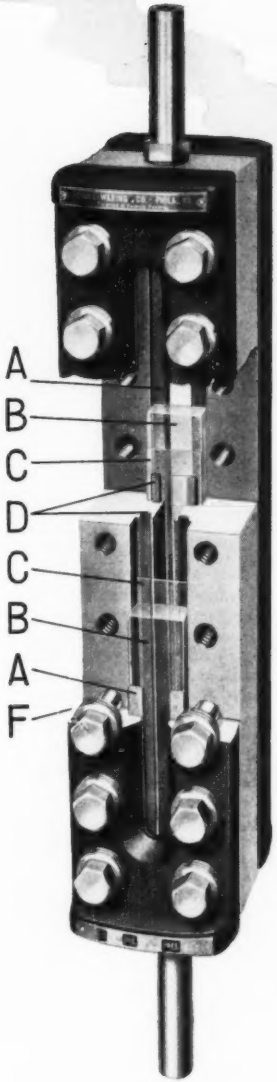
In our study of Fig. 6 we found, when tube $E$ bias decreases, that of tube $E_1$ increases. Likewise, when bias on tube $E$ increases, bias on tube $E_1$ decreases. For this reason, output curves $ABC$ and $CDE$ are reversed for 2-stage amplification compared to single-stage.

All voltage changes in Fig. 6 are ac waves. For example, we can assume the first wave to be curve $A_2B_2C_2$, Fig. 4, with a maximum of 0.25 v. This voltage applied to the grid caused output voltage across $R_1$ to increase as a wave $ABC$ with a maximum of 2.5 v. As the voltage increased on the + side of the capacitor, a current wave flowed from its − side through resistor $R_2$. This current produced a voltage wave across $R_2$ that increased the

(*Continued on page* 150)

# "Floating Assembly" Water Gage

## REDUCES LEAKAGE and GLASS BREAKAGE




Yarway offers help to the steam plant engineer who has the problem of leakage and glass breakage on flat glass water gages. It's "floating assembly."

Research shows a flexible feature is required to prevent leakage and excessive loading of glasses. *Spring cones (F), under the cap nuts fastening independently adjusted covers and glasses in place, provide this flexibility.* The "floating assembly" loading is predetermined . . . is maintained by cap screws which shoulder on the insert body, limiting the spring cone compression to that required. *Front and back cover plates are independently adjusted.*

Engineers say these features help them. They may help you, too.

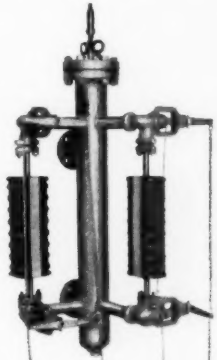
For the full story on "floating assembly" and the Yarway line of water columns and gages, send for Bulletin WG-1811. Or see a model demonstrated in your own plant. Write . . .

**YARNALL-WARING COMPANY**
**100 Mermaid Ave., Philadelphia 18, Pa.**
*Branches in Principal Cities*

●

Cut-away section of Yarway Flat Glass Gage. Front and back cover plates are independently fastened to body by special shouldered cap screws fitted with spring cones (F) which automatically limit the pressure on glasses and gaskets and at the same time allow for expansion and contraction.

Special molded gaskets (D) provide tight pressure-sealed joints between body and glasses. Cushioned asbestos gaskets (A) are placed between cover plates and outer faces of glasses (B). Inner surfaces of glasses are protected by India ruby mica (C).



Yarway Water Column with two Yarway Flat Glass Gages. For pressures from 400 to 2,500 psi.

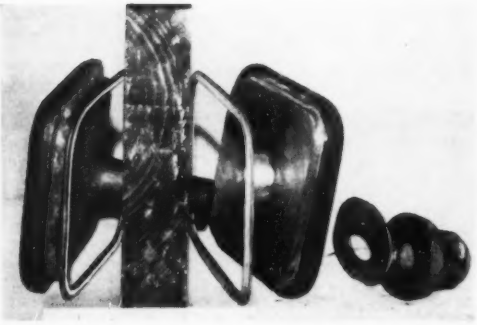
YARWAY

**WATER COLUMNS AND GAGES**

# POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

## DOUBLE PLATES ELIMINATE ECONOMIZER LEAKAGE



WE EXPERIENCED considerable trouble with leakage around square handhole plates in our 250-psig economizers. Trouble usually developed a week or two after having the unit out for inspection and repair. This happened despite successful hydrostatic testing with cold water at 200 psig.

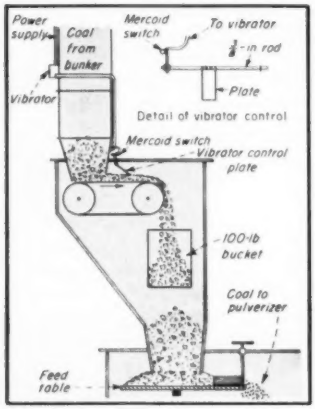
Leakage developed with four different types of gaskets that we tried. The leaks always showed up on the straight sides of the plates. Plates were fastened in place by tightening the nut on the stud against the round caps or binders. See photo at right. We often stripped the stud threads in attempting to compress the gasket.

We solved our leakage problem by salvaging the plates with the stripped stud threads. The studs were machined off and the plates bored with a hole large enough to pass over the plate studs. See photo at left. For a leaking plate we would remove the original round binder and slip a rebuilt plate in place over the stud with a gasket to face against the economizer casing. We used a copper-sheet washer under the box nut holding the plates in place. This arrangement completely stopped the leaking.

The beauty of this setup was that the second plate could be installed while the boiler was operating. Water pressure holds the handhole plate in place while removing the original round binder plate and substituting the rebuilt handhole plate.

F E SCHUBERT *Columbus, Ohio*

## AUTOMATIC VIBRATOR CONTROL KEEPS COAL FLOWING




WET COAL from our bunkers to automatic coal scales feeding pulverizers had a tendency to arch and jam in the chute, ahead of the scales. A hand switch controlled a vibrator mounted on this chute to shake down the coal whenever this condition happened.

When the coal hung up in the chute the belt would run empty. If the operator failed to check the feeder every few minutes the pulverizer would run out of coal. To eliminate this constant vigil we hooked up the vibrator for automatic control. A plate or blade was bolted on a ⅜-in. rod and suspended above the belt so it would hang vertically when there was no coal on the belt, see sketch. A mercoid switch was fastened on this rod so that it was in the closed position when the blade hung vertically, completing vibrator circuit.

When the belt carries coal normally, the plate tilts up, opening the mercoid switch. When coal stops flowing to the belt the plate drops to vertical position closing the switch. The vibrator proceeds to shake down the coal and as soon as it reaches the belt the vibrator automatically stops, because the coal tilts up the plate.

This control does two things: (1) automatically operates the vibrator for constant coal flow (2) sounds an alarm calling for investigation if vibrator fails to shut off after a few seconds. These automatic controls have been in operation for over two years with satisfactory results.

C WERDERITCH *Albert Lea, Minn.*

*(Continued on page 122)*

# DIESEL MAINTENANCE CUT 50%

## Sun Diesel Lubricant Eliminates Hard Carbon, Stops Sludging, Ends Costly Bearing Failures

Troubles began to pile up for a company renting out diesel-powered cranes, air compressors, and heavy-duty earth-moving equipment. Piston rings stuck with hard carbon; sludging resulted in clogged oil pump screens, bearing failures, abnormal cylinder wear. As a result there was frequent necessity for complete engine overhauls. Downtime was excessive.

A Sun Diesel Lubricant proved to be the solution to the difficulties. This "Job Proved" Product, recommended by a Sun Engineer, has been used by this concern for two years now. There have been no stuck rings, no bearing failures traceable to lubrication, no clogged oil pump screens. Cylinder wear is at a minimum. General maintenance costs have been reduced 50 percent. Efficiency is way up—to the profit of both owner and users.

Here is another example of what Sun "Job Proved" lubricants are doing to increase the life and efficiency of machinery. By helping to improve output and quality, and at the same time hold costs down, they can play a large part in making operations show a profit. It will pay you to consider how Sun "Job Proved" Products can be used to advantage by your company. Call your nearest Sun Office for complete information.

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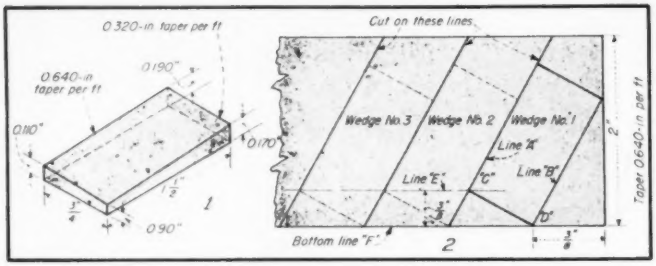
**SUN PETROLEUM PRODUCTS**

**"JOB PROVED" IN EVERY INDUSTRY**

SUNOCO

 (Continued from page 120)

## HOW TO MAKE COMPOUND WEDGES QUICKLY




DURING A ROUTINE turbine inspection we found it necessary to replace some old blades. New blades were on hand but not enough wedges to fasten them in place. To order new wedges would delay placing the unit back in service, so we decided to make them up ourselves.

Fig. 1 shows the wedge dimensions. Here's how we went about producing them in quantity. We took a piece of soft-iron flat stock, 2 in. wide and 0.250 in. thick, Fig. 2. Length will be determined by the size of shaper or milling machine used to machine the piece. The work was set up to machine a taper of 0.640 in. per ft on the long side of wedge, corresponding to the 2-in. side of the flat stock.

To lay out the proper angle to cut wedges the right width and taper on the narrow side (0.320 in. per ft) we measured off ¾ in. from edge of machined material, then up ⅜ in. to locate reference line *E*.

Point *D* on line *B* (the starting point for laying out wedge) was located by measuring the required thickness, 0.090 in. Point *C* on line *A* was found by laying off wedge width, ¾ in., so one end of the line is at *D* and the other cuts line *E*.

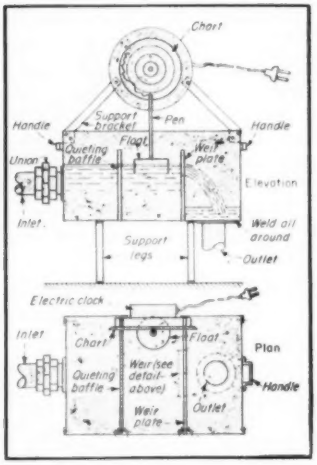
Then *A* was laid off perpendicular to line *CD* from *C* and parallel line *B* from point *D*. A line parallel to *CD* was drawn 1½ in. away. This gives the needed length of wedge.

Lines parallel to *A* were laid off ¾ in. apart, allowing for width of saw cut, until the whole length of material was used up. The first wedge cut was used to square the edges of the remaining wedges. Squaring off ends of wedges to needed length can be done in groups with a power saw.

F J HERZINS *Tyrone, Pa.*

## HANDY CONDENSATE METER AIDS SMALL-PLANT TESTING

IN A LAUNDRY POWER PLANT we had trouble finding the quantity of condensate returning from drying tumblers, flat-work ironers, sleeve forms and other equipment. Standard flowmeters were unsuitable for the small quantities we wanted to measure. So we built our own meter, shown in the sketches below at the left and right.




The 36×24×12-in. tank was made of 12-gage wrought iron. Corners were riveted and inlet and outlets were cut. These openings were reinforced by welding circular plates to tank side and bottom. Two 3-in.-dia nipples welded to inlet and outlet were threaded for pipe connections. A perforated quieting baffle, brass weir plate, handles and supporting legs were provided.

The weir was a 60-deg triangular unit, suitable for measuring discharges varying from a moderate maximum down to about 1 gpm. The meter was calibrated by the relation:

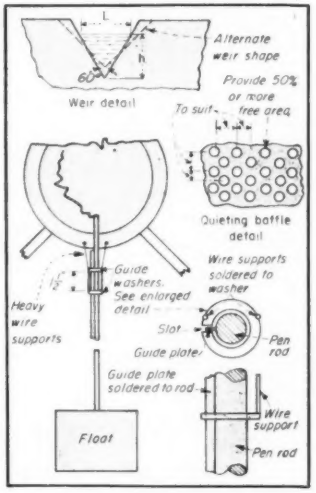
$$Q = 0.155Lh\sqrt{2gh}$$

Where $Q$ is in cu ft per sec, $L$ and $h$ in ft, and $g$ is 32 ft per sec per sec. An electric clock drives the chart. A 4-in.-dia float moves the meter pen.

Vertical movement of the pen was guided by two washers spaced about 1½ in. apart and soldered to heavy supporting wires. To prevent float rotation a slot was cut in each washer to take a 1/8×1/6-in. guide plate soldered to the rod. Friction between rod and washers was negligible because of low water velocity past the float.

This tank was carried from machine to machine and readings obtained at each unit over a period of several days. Flow rates obtained by this meter agreed very closely with weigh-barrel tests. The values obtained in tests are used to charge steam consumption to the various plant departments. Several weir sizes permit making capacity changes as needed by the application.

TYLER G HICKS *New York, N. Y.*



# *Payday...*

## for a BOILER PLANT!

Every day is payday for a boiler plant when profits are poured back into it because of inefficient water conditioning. These profits "pay for" excessive blowdown, scaling, corrosion and foaming.

Correct water conditioning is a matter of careful and scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical.

Our nationwide staff of engineers will welcome the opportunity of discussing your boiler water problems . . .
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# BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

# PROBLEMS FROM THE PLANT

**Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay**

## WHAT STEAM PRESSURE IS NEEDED FOR VAT HEATING?

HERE'S ONE that's really off the beaten path. It involves cooking malt and corn. We have to handle the piping job in connection with a steam-heated vertical sheet-steel vat. The vat is 8 ft high with an inside diameter of 13 ft. It will be steam jacketed at the bottom and 2½ ft up the sides. A separate mechanism is provided to stir the mixture while cooking. Total inside heating surface is 233 sq ft.

Mixture will consist of 1000 lb malt, 3100 lb grits (corn) and 20,900 lb water. The first heat will bring the temperature of the cook from the original 113 F to 158 F in 15 min. After this there is a rest or holding period of 30 min during which the temperature is kept at 158 F. Then the second heat brings the mixture to 212 F in 20 min.

Assuming proper condensate drainage and air elimination our problem is to determine the steam pressure to be carried in the jacket. On top of that we have to know the steam flow and pipe size to the jacket. We will use two traps and our next problem is to determine the size of each. We would certainly appreciate getting the thoughts of POWER's readers in connection with both the steam pressure, flow, pipe size and trap size.—*CP*

## READERS' ANSWERS

### What Are Advantages Of Grounded System?

*(This question is from August issue with best answers from readers.)*

*Here's a problem we have been tossing back and forth during the past few weeks. Many of the boys here in the plant disagree with me regarding grounded vs ungrounded electrical systems in industrial plants.*

*In our particular plant we have two Y-connected 2000-kw 11.5-kv generators. At the time of installation we considered it best to leave the generator neutrals ungrounded. Our thinking was that in the event of an accidental ground the static ground detector on the main switchboard would light; then we would go to work and find the point of trouble.*

*On the other hand, many boys in our plant believe a grounded neutral on the generator offers the safest and most dependable system. We would appreciate hearing from* POWER *readers to get their slant. We probably wouldn't do anything about it here but it would keep our thinking straight on the general subject of grounding.—DR*

### Can Use Both Methods

IN A UTILITY generating station connected to a transmission or distribution system the generators should be grounded. While there is considerable discussion about the method to use, whether solid grounding, resistance grounding, reactance, impedance, or grounding via a circuit breaker in neutral, the consensus seems to be that grounding of such a system is desirable.

An industrial plant, however, presents a different problem. From the safety angle while generating at 11.5 kv, there is little choice. At such a high voltage the current that would flow through a person touching a phase lead would be considerable. This can be traced to the capacitance of the system to ground. With a grounded neutral, of course, there would be 6648 v directly across anyone touching a phase wire, and the contact would undoubtedly be fatal. The ungrounded system, here at least, has a shadow of an advantage.

Insulation strain is another factor to consider. When a ground occurs on a system with isolated neutral, the voltage to ground of the unfaulted phases immediately becomes full-line voltage, which is 1.73 times the normal phase-to-neutral voltage. This abnormal voltage may cause flashover of insulators, or rupture faulty cable insulation. But if the cable, insulators, and associated equipment have been purchased with this condition in mind and are rated for full-line voltage they can be expected to stand up.

Type of plant under consideration is another item that has a bearing on the question of grounding. A plant that requires maximum continuity of electrical power might well be better off with an ungrounded system. With a grounded neutral any ground on a phase causes current flow, and will result in the generator tripping off the line. An alternative is to have a circuit breaker in the neutral with a relaying setup that will open the neutral in case of a ground. This results in ungrounded operation, and until the fault is cleared, it can be considered that the system never was grounded. But the fact that ground current will flow, on a grounded neutral setup, does allow some discrimination in relaying. Knowing the resistance, reactance or impedance of the ground connection, the plant engineer can make use of ground relays, in addition to his other protective relays, and thus get an idea of the seriousness of the accidental ground. Ground relays may be arranged to either sound an alarm, trip the neutral breaker (if any), or trip the generator line breaker. With an ungrounded system ground detectors must depend upon capacity between system and ground. And this capacity will vary with the number of motors or other equipment in service at any particular time. Hence an effective relaying scheme would be difficult to set up and maintain.

NORTON SAVAGE *Sewaren, N. J.*

### Tip on Ground Detectors

GROUNDING OF GENERATOR NEUTRAL is preferred since it maintains a fixed voltage to ground, reducing the hazard to both equipment and operating personnel. Grounding also permits use of relays to quickly disconnect the faulty equipment. On the other hand, many operating engineers feel that greater reliability is secured by not grounding the neutral since the system can be operated with one phase grounded while the plant electrician locates the trouble.

Under normal conditions (neutral ungrounded) phase-to-phase voltage in the system under discussion is 11.5 kv. But with one phase grounded the voltage

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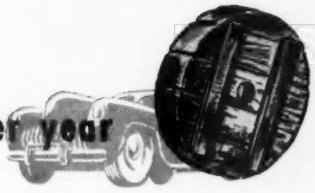

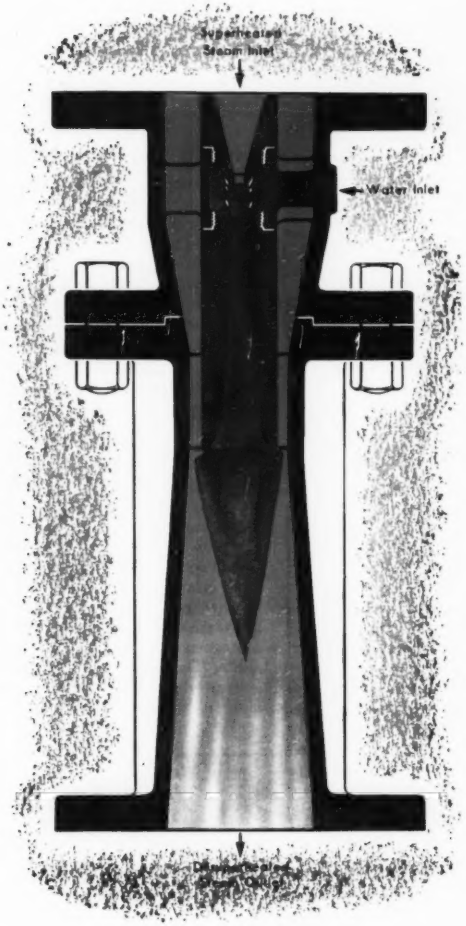


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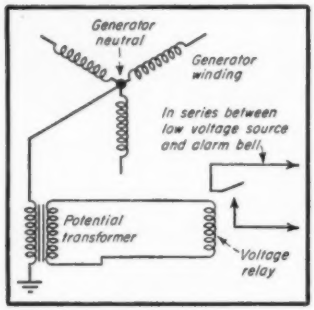
between the remaining phases and ground is 11.5 kv. This means equipment should be suitable for use on 11.5 kv to ground.

And nearly always where equipment




failure causes a ground, the shift in line-to-ground voltage of the other phases may cause failure of additional equipment on the other phases.

Ground detectors must be used with ungrounded systems. Electrostatic type is undesirable since it requires full-line voltage on the operating board. For those plants that still use ungrounded systems the detector shown above is preferred. Device consists of a potential transformer with the primary connected between generator neutral and ground. The pt secondary connects to a relay with normally open contacts. The contacts, in turn, connect a source of power to an indicating device such as a horn, bell or light. Voltage across the primary varies from zero for no-ground to 6.6 kv for a solid ground. Relay can be set to operate at any point between these limits.

G W BENEDICT *Montpelier, Vt.*

## Consider Insulation

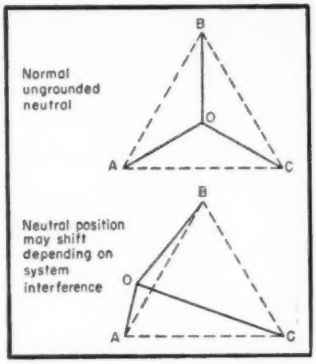
MAJOR ADVANTAGES of grounded systems are the uniformity of voltage to ground and immediate indication in the event of a fault to ground. With an ungrounded system, voltage to ground varies.

With a grounded system, a fault to ground must be remedied at once since it is essentially a short circuit from a line to neutral. On the other hand, an ungrounded 11.5-kv system, particularly if it includes much underground cable, can run into a snag if accidental grounds are allowed to remain on for any extended period. This arises from the charging current flowing to ground at the fault. This may cause insulation to char and carbonize. From actual experience I find the damage resulting from a ground fault allowed to continue on an ungrounded system may be greater than one on a grounded system where the trouble is cleared at once.

A Y-connected generator is shown below. Actual phase windings are *AO*, *BO* and *CO* giving resulting voltages of 11.5 kv line to line. With point *O* not grounded the neutral point *O* will shift depending on leakage and electrostatic relation of *A*, *B* and *C* to ground. Position of point *O* may shift in any direction even to the point where *O* is outside the triangle *ABC*.

Remember the voltage stress on the winding insulation can vary anywhere from line-to-neutral voltage to line-to-line value. While this may not be a serious factor on insulation in the 11.5-kv range, it becomes much more when operating at high voltages, and has a direct bearing on machine cost.

For a high-resistance generator fault the usual type of differential protection may not clear the unit having a grounded




neutral. Hence it is not unusual to have additional protection (ground relay) included between point *O* and ground. Many installations have a resistor between point *O* and ground to limit the flow of fault current. While a resistor reduces shock to generator winding it raises the stress to ground on the machine insulation. This additional stress depends on the value of the neutral resistor.

Remember that the larger the value of the neutral resistor, the greater the voltage between the remaining two phases and machine ground. This value of voltage keeps increasing till the resistance between the phase in question and neutral is infinity. In effect, this will then be an ungrounded system. On accidental grounding of any one phase, voltage from any of the remaining two good phases to machine ground will be equal to line-to-line potential. Hence, with this in mind, consider all factors before installing any resistor.

C O VON DANNENBERG *New York City*

## Reasons for Grounding

REASONS FOR NEUTRAL GROUNDING are (1) to establish a definite ground potential (2) hold insulation stress to a minimum and (3) make possible use of simple but sensitive differential and ground relays to disconnect the machine or load equipment in case of insulation failure.

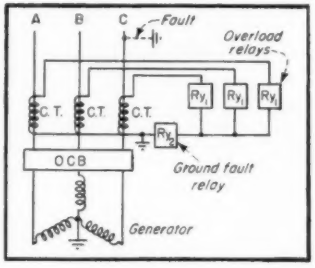
E A ROBERTS *Carlsbad, N. M.*

## Should Be Grounded

AC GENERATORS above 600 v should have their neutrals grounded. If a ground fault occurs on one phase of an ungrounded generator, voltage between the two remaining phases and ground immediately rises to full-phase voltage. On a grounded star-connected generator, phase voltage to ground will remain at about $E \div \sqrt{3}$. Rise in voltage to ground, in an ungrounded generator during ground fault, imposes extra strain not only on the generator winding itself but on the insulation of the connected busbars, cables, transformers, etc.

An ungrounded neutral star-connected generator will operate when connected to an ungrounded neutral load with a phase to ground fault. But if a fault should occur on one of the other phases, short circuit would result.

When generator neutral is grounded it is possible to apply simple relay protection against phase-to-ground faults. The circuit for this protective system is shown in sketch below. If a fault occurs, such as shown on phase




*C*, neutral current will equal current in this phase. The extra current in phase *C* will cause the resultant of the unbalanced relay currents to flow through

*(Continued on page 152)*

For special conditions:

# Anaconda Duplex Tubes

**ANACONDA Duplex Heat Exchanger Tubes** on request are supplied with the ends of the external tube cut back to receive ferrules for rolling into the tube sheet. Ferrules can also be supplied.

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# TECHNICAL BRIEFS

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## REVIEWED IN THIS ISSUE

**FUELS AND FIRING:** Practical Considerations in Industrial Oil Firing • Design Considerations for Oil-Fired Settings of Small Boilers • Flyash Erosion in Boilers

**SMOKE ABATEMENT:** Administrating Air-Pollution Laws

**WELDING:** Importance of Design in Tanks and Pressure-Vessel Construction • Trends in Fabrication by Welding

**PUMPS:** Factors Affecting the Selection and Application of High-Pressure Pumps, Valves and Fluid Motors

*Directions for ordering papers are given on page 130*

## FUELS AND FIRING

PRACTICAL CONSIDERATIONS IN INDUSTRIAL OIL FIRING, *by H E Schwieberg, Socony-Vacuum Oil Co, Inc.* In any discussion of the broad aspects of fuel-oil use in industrial combustion, only fundamental, almost elementary, considerations can be made.

One point is the need for good combustion engineering skill in laying out a new oil-fired job. Next, the decision to use fuel oil rather than coal or gas should be based on several important factors.

First, economy. Just comparing relative fuel costs on the dollars per Btu of heating value basis is not enough. Overall costs of firing operation should be the deciding basis. These costs include actual operating ones, such as labor, supervision, maintenance, repair, fuels and power consumption, plus a realistic charge for amortizing the original investment over the useful life. Beyond these considerations are the ones of immediate availability, probable future supply.

Now, how about choice of burner? The steam-atomizing burner is the simplest type and perhaps that is its outstanding feature. It is about the only type that can handle almost any fuel oil or tar, including those of maximum viscosity and with high sediment contents. As a class these burners are very good from the point of view of troublefree operation.

Mechanical atomizing burners release oil under pressure (up to 300 psi) through a small orifice after giving the oil a rotational spin. This burner gives the cheapest means of atomization. But it is sensitive to fuel-oil condition. Suspended solid particles can plug up the orifice, and heat coking of the oil in the nozzle occurs fairly easily.

Rotary-cup burner spins fuel oil off the edge of a conical cup rotated at high speed. Its characteristics fit it very well to small steam boilers. The burner is somewhat susceptible to coking from heat radiated back by the high-temperature furnace zone.

The author then discusses the essentials of good combustion from oil firing. Next, he takes up the residual grades of fuel oils. He defines and explains the grades and characteristics of fuel oils. Tables I and II show some of the classifications and properties of fuel oil. *ASME Paper No. 49-F-17.*

OIL-FIRED SETTINGS FOR SMALL BOILERS, *by Kalman Steiner, C Hoffberger Co.* Many factors enter into the design of the setting and furnace of an oil-fired boiler. In the industrial and power-plant boilers the engineering and operating problems usually influence design. Smaller boilers, however, do not enjoy such considerations. Too often, the design of the setting for a small boiler, in the range of about 8000-lb-per-hr capacity, becomes the responsibility of a plumbing or heating contractor.

Basis for design of a boiler setting is boiler rating. In the small-boiler field at least four systems of units are in common use: sq ft of steam radiation, sq ft of hot-water radiation, boiler horsepower, boiler heating surface. Two kinds of capacity rating are recognized: gross output rating, net load rating. It is the author's feeling that the ideal-capacity rating term would be in Btu per hr for the small-boiler field.

In a similar fashion the confusion in boiler-setting ratings should be dissolved, says the author, by expressing input to the firebox in Btu per hr. A basic rate of heat release for design purposes is advanced as 24,000 Btu per cu ft per hr. This would allow, at a combustion efficiency of 70%, a furnace volume of 2 cu ft per developed bhp (boiler horsepower). The author apologizes for employing the term bhp but says it is so widely used in the small-boiler industry that it is readily grasped.

Following the discussion of heat-release rates the paper describes a num-

### Table I — Residual Fuel-Oil Classifications

Listed Standards—Commercial and Pacific Coast

| | Commercial 12-48 | | | Pacific Coast | |
|---|---|---|---|---|---|
| *Fuel-oil property* | *No. 4* | *No. 5* | *No. 6* | *No. 300* | *No. 400* |
| Viscosity, max ssf at 122 F | — | 40 | 300 | 40 | — |
| ssu at 100 F | 125 | — | — | — | — |
| Viscosity, min ssf at 122 F | — | — | 45 | 25 | 60 |
| ssu at 100 F | 45 | 150 | — | — | — |
| Pour point, max, F | 20 | — | — | — | — |
| Ash, max weight, % | 0.10 | 0.10 | — | — | — |
| Flash point, min, F | 130 | 130 | 160 | 150 | 150 |
| Water and sediment by centrifuging, vol, % | 0.50 | 1.0 | — | 1.0 | 2.0 |
| Sediment by extraction, wt, % | — | — | 0.50 | — | — |
| Water by distillation plus sediment by extraction, % | — | — | 2.00 | — | — |

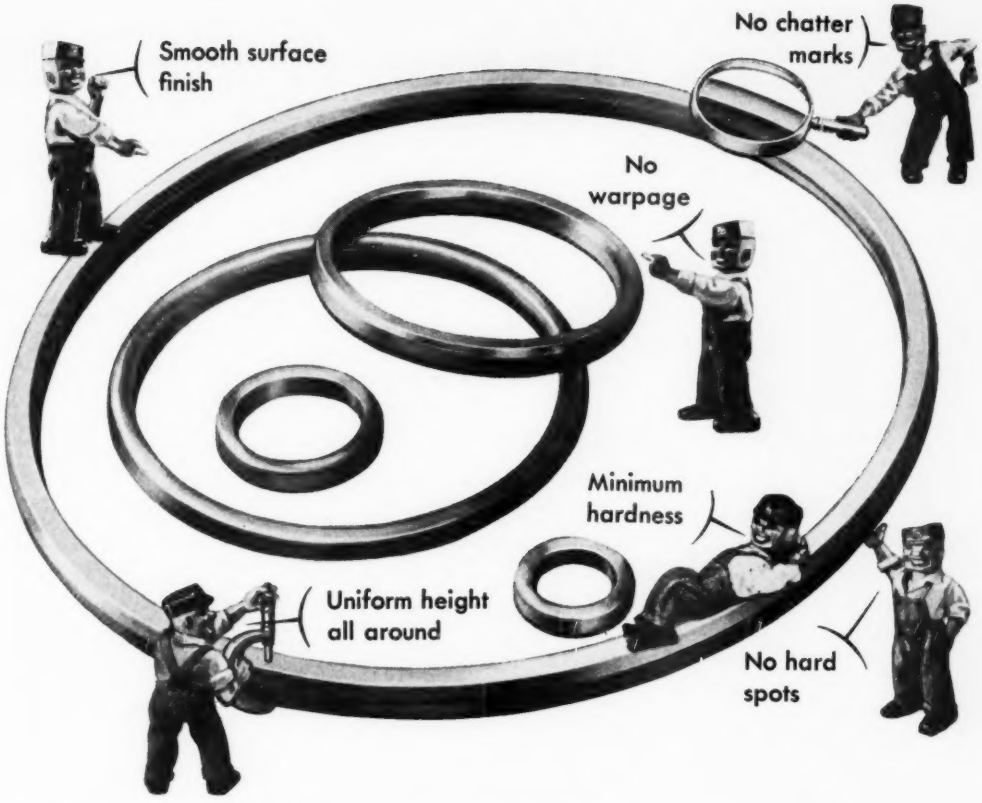
### Table II — Properties of Bulk of No. 6 Fuel Oil

Supplied in Eastern part of the U. S.

| *Fuel-oil property* | *Range of values* |
|---|---|
| Gravity, degrees API | 10—15 |
| Viscosity, ssf at 122 F | 115—200 |
| Carbon residue, wt, % | 10—14 |
| Sulphur content, % | 1.0—3.0 |
| Ash content, % | 0.05—0.30 |
| Pour point, F | 15—75 |
| Water by distillation plus sediment by extraction, % | 0.2—2.0 |
| Flash point, F | 200—290 |

Ssf-saybolt seconds furol — Ssu-saybolt seconds universal

A furol second is approximately equal to 10 universal seconds.

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In addition to soft iron, Goetze V-Tite Gaskets are made in a number of alloys in all standard ASA and API shapes and sizes. Gaskets of special dimensions are also available. For further details, write for Catalog PK-35A. Johns-Manville, Box 290, New York 16, N. Y.

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ber of typical boilers and illustrates the correct boiler setting for them. *ASME Paper No. 49-F-16.*

FLYASH EROSION IN BOILERS, *by Arthur R Weismantle and Nicholas Artsay, Foster Wheeler Corp.* Erosion of boiler parts, when encountered, is one of the most aggravating the power-plant operator has to face. This source of trouble is not necessarily common to all boilers in the same plant, to all boilers fired by the same fuel or methods of firing, or even to all boilers of the same design. This illustrates the complexity of the problem and the difficulty for both operators and designers to foretell when any installation will become troublesome.

Of the many boilers this manufacturer builds there are only five that have reported flyash erosion. The firing equipment on the types made by this concern includes practically all known methods and fuels. So the design principles and the values employed are apparently sound. But a study of the factors involved in each case where flyash erosion developed should prove interesting.

The paper goes on to describe in detail the installations themselves, then all the possible factors contributing to flyash erosion. From these experiences certain qualitative conclusions are drawn, summarizing the causes of flyash erosion. Next, limiting values on these causes are advanced, as determined by this company's experiences. *ASME Paper No. 49-F-21.*

## SMOKE ABATEMENT

ADMINISTRATION OF AIR-POLLUTION LAWS, *by Harry J Harp, Philadelphia.* Early in the century when it became generally accepted that industry was polluting the air, we looked around for causes and settled on smoke.

Actually, smoke isn't too bad a pollutant where health is concerned. It is dirty, though, and so we try to remove it. In all probability, though, future air-pollution departments will try to cover all types of pollution. As yet we haven't the standards to apply to such a coverage.

The many man-made additions to air are not all beneficial by any means. So we want to remove acid fumes, metallic dust, aerosols of petroleum and other oils. Legislation must be provided to enforce its removal.

Next, we want to control the installation and certificates to operate various pollution-producing devices. That helps the administrator keep a check on all equipment going in his area of supervision. *NAPE Paper. No number.*

## TO OBTAIN COMPLETE TEXT

*Material for these abstracts comes from one of the following sources: American Society of Mechanical Engineers, fall meeting Erie, Pa., Sept* 27-30, 1949, *semiannual meeting, San Francisco, Calif., June* 27-30, 1949. *Papers are identified by initials ASME. Obtainable through ASME,* 29 *W* 39*th St, New York* 18, *N.Y.*

*American Welding Society, annual meeting, Cleveland, Ohio, Oct* 16-21, 1949. *Papers are identified by initials AWS. Obtainable through AWS,* 31 *W* 39*th St, New York* 18, *N.Y.*

*National Association of Power Engineers, annual meeting, Chicago, Ill., Aug* 23-25, 1949. *No copies of papers available.*

## WELDING

IMPORTANCE OF DESIGN IN CONSTRUCTION OF TANKS AND PRESSURE VESSELS, *by Walter Samas, Sun Oil Co.* Sound engineering design cannot always be assured by merely applying formulas given in construction codes. A number of actual designs that apparently met code requirements were the subject of a slide discussion. The author pointed out in each the difficulty of making an exact stress-analysis without first obtaining experimental results.

At the same time approximate methods for finding the probable range of stresses were indicated. Preferred alternate designs were shown in those cases where excessive stress could not be reduced to a safe value by change of shape.

Some failures in service were described. They were not due to errors of installation or operation but rather to incomplete design methods. Such methods enforce difficulties in fabrication.

The author feels every designer should bear in mind four main elements governing the application of codes to the construction of welded-steel containers for liquids and gases:

(1) Materials act as they are forced to behave. (2) Membrane design formulas can mislead the experienced, especially if they are used as the sole guide. (3) Poor fabrication methods may bring adverse results. (4) Efficient inspection requires more than merely witnessing procedures. *AWS Paper. No number.*

TRENDS IN FABRICATION BY WELDING, *by S V Williams, Struthers-Wells Corp.* Fabrication methods and practices have been revolutionized by modern welding. It has led to the development and perfecting of better materials since welding reveals hidden and inherent weakness in any metal. Welds can be made of greater strengths than ordinary commercial materials and, as a result, materials of greater strength-weight ratio are now available for fabrication.

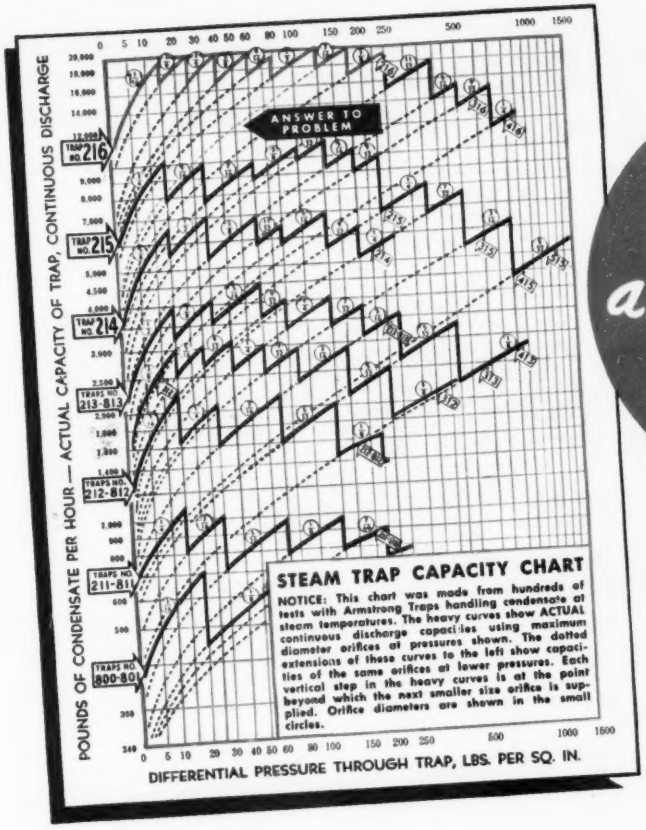
Fabrication of process equipment has received great impetus. Truly sanitary conditions in such equipment can result from proper welding. What is more, many design limitations on location of openings, type of closures, size of vessels, and pressures and temperatures have been eased or removed. In all, the author looks for considerably more fabrication by welding in almost all fields. *AWS Paper. No number.*

## PUMPS

FACTORS AFFECTING THE SELECTION AND APPLICATION OF HIGH-PRESSURE PUMPS, VALVES AND FLUID MOTORS, *by Herb Vickery, The Rucker Co.* This paper deals with problems and factors to be considered in selecting and applying modern high-pressure hydraulic pumps and fluid motors in machine design. It includes development and advantages of fluid power, requirements of hydraulic fluid filtration, heat-dissipation, piping and fittings, dual vane pumps and fluid motors, selection of pumps and fluid motors, axial-piston pumps and fluid motors, pump controls, circuits and valving.

Fluid-power transmission, with its smooth acceleration and retardation, its rapid start, stop and reverse, its infinite speed variation, and its automatic cushioning, overload protection and torque control, materially improves operation of many machines. High starting, stalling, and running torque permits elimination of a great deal of intermediate gearing and, on many applications, permits direct drive. Accurate control of speed, regardless of load variation, and flexibility of installation, which permit hydraulic motors to be mounted in any location regardless of water, dirt or explosive hazards, are distinct advantages in many types of machines on hard-to-handle jobs. Their compactness and high torque and horsepower output for their size, as well as the variety of controls available, often permit simplification of construction.

Recent developments in design and construction of axial-piston pumps now make them available for continuous operation at pressures of 5000 psi on low-viscosity hydraulic fluids. Efficiency of such pumps operating at high pressure is great. At least 95% volumetric efficiency is guaranteed, and actual volumetric efficiency runs as high as 97 to 98%. Axial-piston fluid motors of this type are available in sizes up to 98 hp. *ASME Paper No. 49-SA-25.*


ANSWER TO PROBLEM
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TRAP NO. 214
TRAPS NO. 213-813
TRAPS NO. 212-812
TRAPS NO. 211-811
TRAPS NO. 800-801
POUNDS OF CONDENSATE PER HOUR — ACTUAL CAPACITY OF TRAP, CONTINUOUS DISCHARGE
DIFFERENTIAL PRESSURE THROUGH TRAP, LBS. PER SQ. IN.
STEAM TRAP CAPACITY CHART
NOTICE: This chart was made from hundreds of tests with Armstrong Traps handling condensate at steam temperatures. The heavy curves show ACTUAL continuous discharge capacities using maximum diameter orifices at pressures shown. The dotted extensions of these curves to the left show capacities of the same orifices at lower pressures. Each vertical step in the heavy curves is at the point beyond which the next smaller size orifice is supplied. Orifice diameters are shown in the small circles.

# HOW TO SOLVE a Steam Trap PROBLEM:

BECAUSE good trapping starts with selection of the right trap for the job, Armstrong has provided all the data necessary for correct trap selection in the Armstrong Steam Trap Book. The Capacity Chart reproduced here is taken from this handy reference work. By means of this chart, any engineer can select the correct traps for his requirements. Here is a typical problem showing how the chart is used:

*Given:* An evaporator condensing 6000 lbs/hr at 50 psi when the steam is first turned on, but condensing only 1000 lbs/hr at 150 psi at the end of the process. Safety factor of 2 to 1 required at the *minimum* pressure differential.

*Solution:* Referring to the chart, the No. 216 Armstrong Trap with 7/16" orifice for 150 psi pressure has a capacity of 12,000 lbs/hr at 50 psi. This provides for the 2 to 1 safety factor and is, therefore, the correct trap for the job.

The Armstrong Steam Trap Book provides recommended safety factors for different services and handy tables to help you calculate condensing rates. Other useful data included are: hook-up diagrams; do's and don't's; trouble-shooting tips; prices and specifications. You're welcome to a copy. **ARMSTRONG MACHINE WORKS, 812 Maple Street, Three Rivers, Michigan.**

ARMSTRONG Inverted Bucket STEAM TRAPS

*For fuel savings, low maintenance, automatic air removal* **SPECIFY ARMSTRONG!**

# POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

## AEC Negotiates For Architect-Engineer For New Reactor

► NEGOTIATIONS ARE UNDER WAY between Atomic Energy Commission and Chemical Plants Div of Blaw-Knox Construction Co, of Pittsburgh, Pa., for architect-engineer services for design of a materials-testing reactor. Announcement of the negotiations by L E Johnston, AEC's manager of Idaho operations, indicates that the reactor will be used at the newly planned ARCO, Idaho, reactor testing station.

The contract will provide for engineering design of the reactor and for preparation of detailed specifications and cost estimates.

Primary purpose of the new reactor, according to AEC, will be to test various reactor construction materials under intense neutron bombardment—an intensity far greater than any experienced in the present reactors at Hanford Plutonium Works. It will also provide an intense source of neutrons for experiments in nuclear physics.

Dr Lawrence R Hafstad, director of AEC Div of Reactor Development, said that this materials-testing reactor will furnish a way of testing fuel and structural materials under severe conditions of temperature and radiation to which powerful reactors of the future will be subjected. It will play a vital part in development of atomic plants for power production and also atomic engines for propulsion of ships and possibly aircraft.

Research development and preliminary design of the reactor was begun

(*Continued on page* 194)

World Wide Photo

## McNary Hydroelectric Project Takes Shape

Huge concrete piers rise like battlements to give preliminary form to spillway section of McNary Dam on Columbia River, between Oregon and Washington. Third Federal Government plant on this mighty river of the West, it will add 1,125,000 to the 2,280,000 kw being installed at Grand Coulee, 305 miles up the river, and 564,000 kw in operation at Bonneville, 150 miles downstream from McNary. During floods, when water pours over spillway, destructive force of the current will be curtailed by striking against concrete baffles in vast stilling basin in foreground. Construction of this $227,000,000 project, named for Oregon's late Senator Charles L McNary, is under supervision of the U. S. Army Corps of Engineers

## COMING EVENTS

**Nov 14-18 — Refrigeration Equipment Manufacturers Assn,** 6th all-industry air-conditioning and refrigeration exposition, Atlantic City Auditorium, Atlantic City, N. J. George E Mills, show director, 1346 Connecticut Ave, Northwest, Washington 6, D. C.

**Nov 28-Dec 1—Institute of Power Engineers of Canada,** annual meeting and exhibition, Royal York Hotel, Toronto, Ont., Canada. Secretary, Institute of Power Engineers of Canada, 496 Church St, Toronto 5, Can.

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**Nov 28-Dec 3—22nd Exposition of Chemical Industries,** Grand Central Palace, New York 17, N. Y. Charles F Roth, International Exposition Co of New York, Grand Central Palace, New York 17, N. Y.

**Jan 16-19 — Plant Maintenance Show,** Auditorium, Cleveland, Ohio. Clapp & Poliak, Inc, 341 Madison Ave, New York 1, N. Y.

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**When a fire occurs** the primary water supply valve is opened as are individual liquid chemical and water supply valves on the lines feeding the liquid chemical proportioners. A water hose valve is also provided outside the control house where the fire department may connect for a secondary water supply if needed. As the water flows through the proportioner, it siphons chemical from the storage tank and mixes with it to form the foam.

**In the system shown here,** fire fighting solution can be delivered to fixed nozzles permanently mounted on storage tanks, sent directly to field hydrants where portable hoses are connected, or to both. The proportioners are installed in parallel, all feeding a common header from which field risk and hydrant lines emerge. Drain valves on all lines permit the entire system to be flushed and cleaned after each use. All flow valves are the outside screw and yoke type, providing fast operation and making wedge position apparent at all times.

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Fig. 715-A
BRONZE
FIRE LINE ANGLE VALVE
Renewable Composition Disc
Red Enameled Wheel
Closes tightly against 300 lbs. hydraulic pressure under normal conditions. Withstands hydrostatic test-pressure of 750 lbs. p.s.i.
JENKINS VALVES

**Two sets of Jenkins Valves are recommended** for this system, one for standard industrial installations and the other for Underwriters' Approved installations. The Fig. 715-A Bronze Fire Line Angle Valves used have a clear waterway area of more than 5 sq. in. Resiliency of the composition disc assures drop-tight closure with least closing effort. These Jenkins Valves are approved by the Board of Standards and Appeals of the City of New York.

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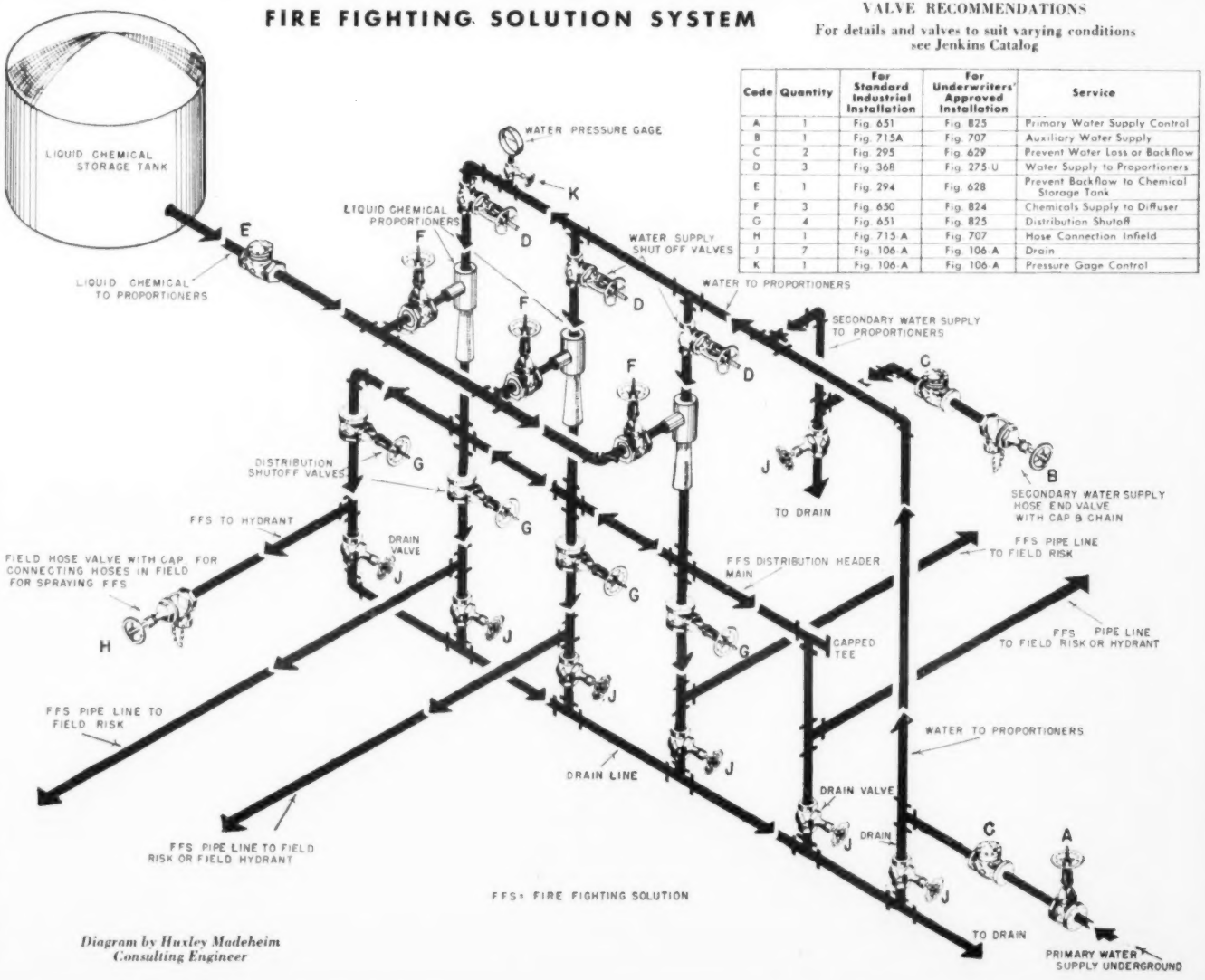
LIQUID CHEMICAL STORAGE TANK
WATER PRESSURE GAGE
LIQUID CHEMICAL PROPORTIONERS
WATER SUPPLY SHUT OFF VALVES
LIQUID CHEMICAL TO PROPORTIONERS
WATER TO PROPORTIONERS
SECONDARY WATER SUPPLY TO PROPORTIONERS
DISTRIBUTION SHUTOFF VALVES
TO DRAIN
SECONDARY WATER SUPPLY HOSE END VALVE WITH CAP & CHAIN
FFS TO HYDRANT
DRAIN VALVE
FFS PIPE LINE TO FIELD RISK
FIELD HOSE VALVE WITH CAP, FOR CONNECTING HOSES IN FIELD FOR SPRAYING FFS
FFS DISTRIBUTION HEADER MAIN
CAPPED TEE
FFS PIPE LINE TO FIELD RISK OR HYDRANT
FFS PIPE LINE TO FIELD RISK
WATER TO PROPORTIONERS
DRAIN LINE
DRAIN VALVE
DRAIN
FFS PIPE LINE TO FIELD RISK OR FIELD HYDRANT
FFS= FIRE FIGHTING SOLUTION
TO DRAIN
PRIMARY WATER SUPPLY UNDERGROUND

*Diagram by Huxley Madeheim*
*Consulting Engineer*

## VALVE RECOMMENDATIONS

For details and valves to suit varying conditions see Jenkins Catalog

| Code | Quantity | For Standard Industrial Installation | For Underwriters' Approved Installation | Service |
|---|---|---|---|---|
| A | 1 | Fig. 651 | Fig. 825 | Primary Water Supply Control |
| B | 1 | Fig. 715A | Fig. 707 | Auxiliary Water Supply |
| C | 2 | Fig. 295 | Fig. 629 | Prevent Water Loss or Backflow |
| D | 3 | Fig. 368 | Fig. 275-U | Water Supply to Proportioners |
| E | 1 | Fig. 294 | Fig. 628 | Prevent Backflow to Chemical Storage Tank |
| F | 3 | Fig. 650 | Fig. 824 | Chemicals Supply to Diffuser |
| G | 4 | Fig. 651 | Fig. 825 | Distribution Shutoff |
| H | 1 | Fig. 715-A | Fig. 707 | Hose Connection Infield |
| J | 7 | Fig. 106-A | Fig. 106-A | Drain |
| K | 1 | Fig. 106-A | Fig. 106-A | Pressure Gage Control |

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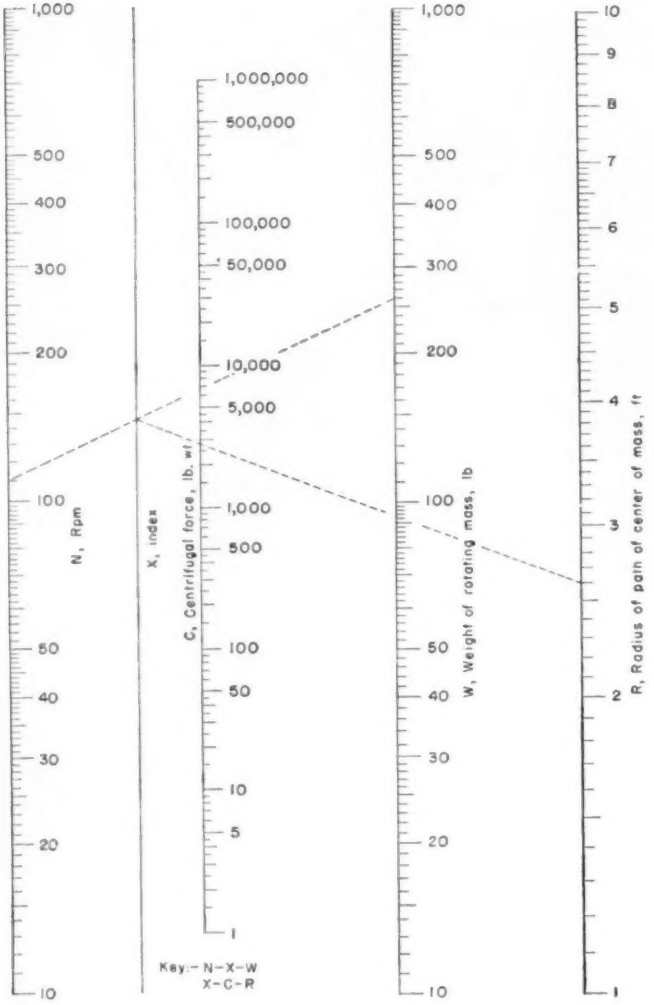
POWER'S DATA SHEETS

Number 209

# How To Figure Centrifugal Force




► To FIND the centrifugal force, $C$ lb, exerted by a weight $W$ lb rotating at a speed of $N$ rpm in circle of $R$ ft, use the formula:

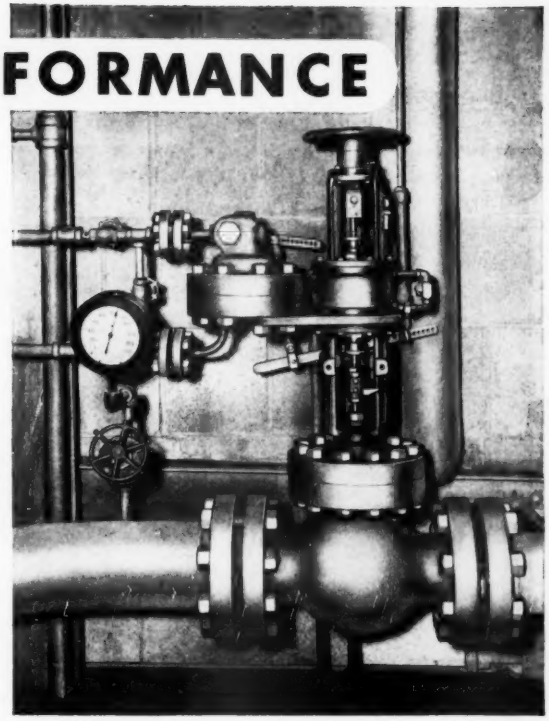
$$C = 0.00034WRN^2$$

The nomogram solves this equation in the following sequence. First lay a straight edge from the $N$ scale to the $W$ scale, and find the intersection with the $X$ scale. From this intersection lay the straight edge to the value on the $R$ scale, and read the answer at the intersection with the $C$ scale.

*Example:* Find the centrifugal force exerted by a weight of 260 lb rotating at 110 rpm in a circle of radius of 2.6 ft. Lay a straight edge from 110 on the $N$ scale to 260 on the $W$ scale, and find the intersection on the $X$ scale. From here lay a straight edge to 2.6 on the $R$ scale and read 2800 lb on the $C$ scale.

By JOHN F HYAM, *Sarnia, Ontario*

# 3-YEAR PERFORMANCE *Sold* 3 MORE FLOWMATICS *at* CALCO



Installed in 1942 at the Bound Brook, New Jersey, plant of the Calco Chemical Division of American Cyanamid Company, this COPES Flowmatic Regulator gave good results from the start—even before combustion was under fully-automatic control—on the 900-psi Riley Type RP boiler rated at 200,000 pounds of steam per hour.

Three years later, Calco installed three more COPES Flowmatics to replace another type of feed water regulator on three older 480-psi boilers, each with maximum capacity of 100,000 pounds per hour. Only routine maintenance has been needed to keep all four COPES Flowmatics giving optimum performance since installation.

COPES Flowmatic Control gives you close control of boiler water level, regardless of range or speed of load fluctuation. Entirely indepdendent of instruments and other controls, it remains on full automatic during periods when they must be out of service for periodic maintenance. Simple and rugged, it handles emergency conditions as safely and dependably as it does normal operation.

These are the reasons why COPES Flowmatics have been ordered for more than 2800 boilers with pressures up to 1825 psi. Why you will find users in all of the 48 states and in 43 other countries. Why operation of your modern high-duty boilers will be safer and more efficient with two-element COPES Flowmatic Control—designed and built for your individual requirements, to fit any piping layout and operating preference.

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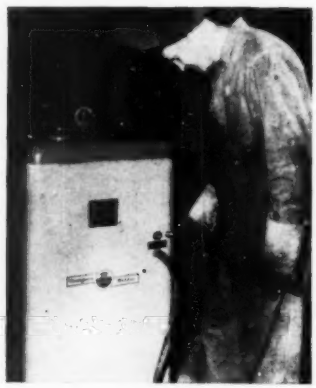


## DC WELDER USES PLATE-TYPE RECTIFIER

**P1101** • Here's a 200-, 300-, 400-amp welding machine that combines characteristics of dc with advantages of ac welding. The thing that makes it possible is combining high-voltage selenium rectifiers and 3-phase adjustable core reactor.

Selenium rectifiers have undergone a continuous development to the point where they are much smaller, lighter and more efficient than other plate-type rectifiers of comparable ratings. Along with the rectifier development a practical, quiet, 3-phase, adjustable core-type reactor has experienced a parallel improvement. It can now be used in the secondary of a 3-phase welding transformer.

The 3-phase adjustable reactor with control handle and sprocket drive mounts in an upright frame that stands on a base assembly, *above, left.* Next, the 3-phase transformer goes into a similar upright frame and is added to the base. An air filter operates between them.

Cross supports on upright frame holding transformer in place serve as supports for selenium rectifier unit. An exhaust fan draws air in through base, filter and on to reactor and transformer units, through rectifier and out the side.

A substantial steel case slips over top of welder assembly and bolts to upright frames and base. Top cover and fan-shroud bolt to case completing the assembly, *above, right,* and protecting welder for both indoor and outdoor service.

Mechanical advantages: The cabinet for a 300-amp rating is about 2 ft sq, 3½ ft high and weighs 510 lb. This represents about 40% of the weight of a motor-generator welder of comparable rating.

Because transformer and reactor are at bottom of the unit a low center of gravity is achieved. This makes the unit as readily transportable as conventional horizontal-type motor generator welder. Since there are no rotating parts except the fan, welder is practically noiseless.

Electrical advantages: The 3-phase transformer gives a balanced 3-phase load and simplifies power-distribution problems. A simple terminal board provides a ready means of connecting the welder for 220- or 440-v operation.

Secondary connectors for welding leads are self-contained, screw-locking types. A one-third turn seats and locks plug into receptacle. No current-carrying parts are exposed. Open circuit voltage is a constant 70 v. Polarity of terminals is fixed so phasing and direction of rotation have no bearing when making connections.

At rated load unit has an efficiency of 66% against 54 for average motor-generator welder. At reduced loads efficiency increases to 73% at 20% rated load. Conventional motor-generator design falls off to 45% efficiency at this load rating.

No-load loss of the new 300-amp welder is 500 watts as compared to 2480 to 3600 watts for the conventional unit. No-load kva input is 0.67 as against 7.1 to 7.7 kva for a typical motor-generator welder.

**Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa.**

**P1115 • ROUND RUBBER BELTS** — For service on valve resurfacers, drills, high-speed hammers, tappers, saws and other small machinery applications, these round endless rubber belts, built without a splice to help eliminate vibration, have cord pull members that keep stretch low.

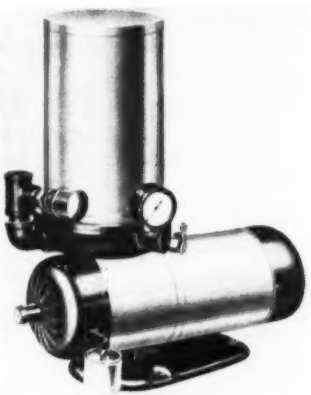
Bias-cut jackets protect inner structure and insure flexibility. Belts are recommended for quarter-turn, mule, serpentine, cross drives and other special wheel-turning applications. They can be shifted on step pulleys for speed changers. Belts are made in diameters of 3/16 to ½ in. and from 6⅞ to 156⅜ in. inside circumference.

**United States Rubber Co, Rockefeller Center, New York 20, N.Y.**

**P1155 • COMBINATION METER** — It is designed specifically for electrolysis and corrosion investigations. Nine ranges, from 10 mv to 100 v, are provided on the low-resistance voltmeter; six ranges from 0.1 to 20 v are available on the high-resistance voltmeter. The milliammeter/ammeter has nine ranges from 2 ma to 20 amp.

Circuit selector switch permits use of low-resistance and high-resistance voltmeters separately or simultaneously. Meter may be used for measuring resistance of shunts, test leads, resistors, etc.

**M C Miller, 1142 Emerson Ave, West Englewood, N.J.**



**P1113 • VACUUM PUMP** — Enclosed vacuum pump is self-contained, including pump, motor and cooling fan. Pump and motor have ball bearings. Motor has thermal overload protection for continu-

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**Take This Pressure Reducer Station,** for example. Here Crane piping equipment meets the need just as it does for any power, process or general service installation. For the Crane line of valves, fittings, pipe and accessories is the world's most complete. You can select everything from one catalog . . . get everything on one order to your local, well-stocked Crane Branch or Wholesaler.

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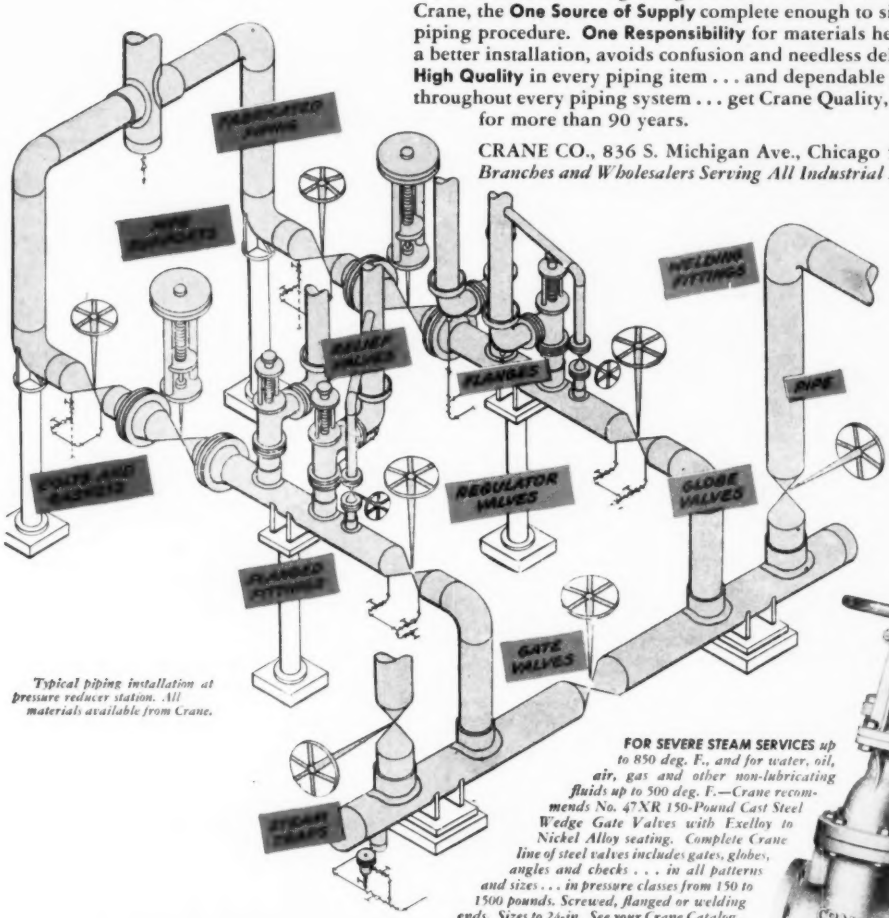


*Typical piping installation at pressure reducer station. All materials available from Crane.*

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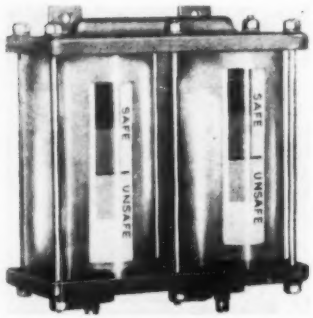
## EQUIPMENT NEWS *CONTINUED*

ous operation without overheating. Pump is available with or without vacuum tank with filter.
**Perfection Mfg Corp, Minneapolis 13, Minn.**




**P1102 • AIR-FILTER DEHYDRATOR** with two transparent tubes, 60 cu in. volume, contains Grade A silica gel fill, which changes color as it absorbs moisture.
**Romec Div, Lear Inc, Elyria, Ohio.**

**P1107 • PILLOW-BLOCK BEARING**—Heavy-duty spherical roller-bearing pillow blocks are for service in industrial, mining, construction, lumbering, petroleum and other heavy-duty fields. They are available in 2 7/16- to 8-in. bore sizes, are self-aligning, have either felt or triple metallic labyrinth seals, and are built for either straight shafts or adapter-type mountings.
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**P1154 • WIRE CONNECTOR**—Model E-1 is designed for joining wires up to four No. 18. The inside of the porcelain connector's skirt is threaded throughout, making it easier to insert wires, and screw connector on. Same threads hold insulation up inside connector so that stripped wire ends are completely covered and protected.
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**P1127 • STEEL ELECTRODE**—General-purpose electrode *Eutectrode* 6000, ac or dc, for steel sheet and plate welding, permits good welds at difficult "poor fit" joints.

Arc-welding electrode is recommended for single or multiple pass welding. It has a high burnoff rate, so high currents may be used to give faster welding speeds. *Eutectrode* 6000 is coated with *Frigid Arc* for lowest possible welding heat. Welds solidify rapidly, are smooth and dense, and machinable as soon as deposited or after heat-treating. Electrode is available in 3/32, 1/8, 5/32 and 3/16 in. sizes.
**Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N.Y.**

**P1126 • SMOKE-DETECTOR**—Selector valving system enables smoke detection for fire protection in four spaces simultaneously. A centrally located control cabinet receives samples from accumulators in remote spaces.

Cabinet contains an electric panel with automatic supervisional circuits, constant-voltage transformer, exhauster fan, and motor-driven selector valving system. The accumulators feed through rigid piping to an analyzer near central cabinet. The analyzer can be made to ring an alarm or bell electrically if sample analyzes 3% or more smoke.
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**P1103 • LIGHTWEIGHT BEARING PULLER** substitutes for an arbor and assorted step plates in removing and replacing fans, ball bearings, races, seals from shafts.
**Double B Tools Co, 1561 E 27th St, Cleveland 14, Ohio.**

(*Continued on page* 142)

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**Insulation Tester** takes insulation resistance and dielectric absorption measurements on cables, transformers, etc. Device has four voltage ranges, for variable dc up to 10 kw ..... page 142

**Panel Instruments** housed in molded dustproof and moisture-resisting cases for dc, thermocouple and rectifier duty ..... page 144

**Diesel Engine** redesign for a 2-cycle unit yields 38% more hp for stationary service. Engine can be arranged for dual-fuel operation ..... page 164

**Diaphragm Pumps** use motor or engine drive to handle liquids too heavy for self-priming centrifugal pumps ..... page 144

**Spreader Stoker** that can burn wood chips, sawdust, or cheapest sizes of coal has a worm feed push fuel into a low-pressure air stream for distribution over grate surface. The air lifts fuel out over grate ..... page 166

**For further data on above items use reply cards on page 184a, identifying your request with letter *P* and number**

# REVERE COPPER TUBE
## of Special Bending Temper . . .

### . . . saves bending time, enables WESTERN BLOWER CO. to produce neater, more uniform tube bundles.

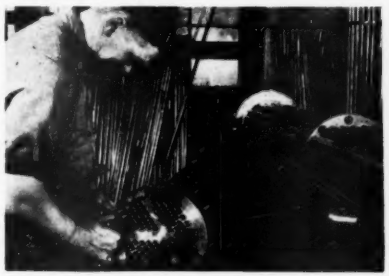
During the past nine years, Western Blower Co., of Seattle, Wash., has used hundreds of thousands of feet of 5/8" and 1" O.D. Revere Seamless Copper Tube of special bending temper, with .049" wall.

They tell us that in working with this Revere Tube they are able to make large and small radius bends without the slightest difficulty and without heat treating, excepting the smallest 1" radius. This not only saves bending time but, enables them to turn out a better appearing tube bundle . . . an important item with Western Blower as many of their bundles are sold without tanks.

In addition to the above, this company has also used tens of thousands of feet of Revere Cupro-Nickel Tube in heaters where salt water was a problem. For this metal, which is one of the most corrosion-resistant of the copper nickel alloys, can withstand high operating temperatures and is not subject to dezincification.

Have you investigated the Revere metals to see how they might help you with your tube problems? Why not have Revere put the knowledge and experience, gained through years of helping others, to work for you? Call the nearest Revere office today.

*EXPANDING THE TUBE ENDS outside the header of one of the U-bend heat exchangers being turned out by the WESTERN BLOWER CO. Revere products have been used exclusively by this company for many years.*



*FLARING THE TUBE ENDS over the header. These coils, made of Revere Seamless Copper Tube, of Special Bending Temper, are used in tanks for domestic hot water, in side arm heaters, condensate coolers and converters.*

**REVERE**

**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, New York

*Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.*
*Sales Offices in Principal Cities. Distributors Everywhere.*

## EQUIPMENT NEWS *CONTINUED*

**P1146 • AIR FILTER**—*Condensifilter*, designed for instrument air service, filters and dehydrates air and automatically discharges the condensate.

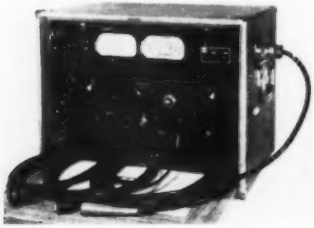
Outer case is 8-in. steel pipe, 51 in. long. Air enters bottom through center shaft and passes over 68 ft of ⅜-in. copper tubing cooling coil. After passing over cooler, air enters a 7-layer Canton flannel filter.

**Hankison Corp, 1501 Beaver Ave, Pittsburgh 12, Pa.**

**P1153 • ELECTRONIC RELAY**—This electronic relay switch can operate on the condensation between two points close together, or a column of mercury. Units may be used as liquid-level controls without need for floats.

Contacts can handle 5, 10 or 35 amp at 115 v, ac. Each unit uses but one electronic tube with a 10,000-hr replacement life.

**Coral Designers, P O Box 248, Forest Hills, N.Y.**



**P1156 • INSULATION TESTER**—Tester takes insulation resistance and dielectric absorption measurements on cables, transformers, rotating machinery, condensers, etc. Breakdown voltages also can be accurately determined with a minimum of burning damage.

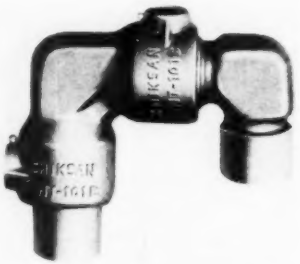
Designed for preventive maintenance field testing and general-purpose production and laboratory use, the *RFL* Model 181*C* has four voltage ranges providing continuously variable dc voltages up to 10 kv. Resistances from 0.1 to 50,000 megohms may be read directly on a megohmmeter scale at open circuit voltages of 0.5, 1, 5 and 10 kv. Safety features include a relay for automatic and rapid removal of dangerous capacitance charges remaining on cables or condensers after test.

**Radio Frequency Laboratories, Inc, Boonton, N.J.**

**P1133 • GAS SCRUBBER**—Centrifugal precipitation of solids and liquids with Aerotec gas scrubbers gives a dry-gas method of removing entrained particles in a moving gas stream.

Gas scrubbers are available in a variety of sizes up to 100,000,000 SCFD. Vertical designs serve where either liquids or solids are removed from gas; horizontal units for liquids such as water or distillates. On a typical pipeline dust average efficiencies of 99.6% are claimed.

**Thermix Corp, First National Bank Bldg, Greenwich, Conn.**



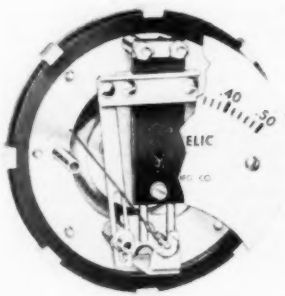
**P1139 • SWIVEL JOINT** — High-temperature swivel joint comes in eight different styles for full 360-deg turning in 1, 2 or 3 planes. It operates at 600 F and 300 psi. Swivel joint is available in ¾, 1, 1¼, 1½, and 2 in. sizes with either threaded or flanged ends.

**Chiksan Co, Brea, Calif.**

**P1130 • ACETYLENE OUTFIT**—Small soldering, low-temperature brazing, heating or lead-burning jobs can be carried out with *Airco* No. 75 air-acetylene outfit.

Outfit comes with four tips: (1) Radiator soldering for flame application in confined places (2) No. 9 tip for medium flame (3) No. 10 tip for a pointed flame for concentrated heating (4) No. 15 tip for a brush flame for heating broad areas.

**Air Reduction Co, 60 E 42nd St, New York 17, N.Y.**




**P1140 • PRESSURE GAGE**—*Magnehelic* gage checks furnace draft, air filters, fans and blowers at air velocities of 400 to 10,000 fpm. It has a range of ½ to 12 in. of water.

**F W Dwyer Mfg Co, 317 S Western Ave, Chicago, Ill.**

**P1169 • HIGH-CURRENT RESISTOR**—Suitable for meeting special requirements for lightness, compactness and reliability, *Multipath* resistor uses a lightweight mesh-type construction. Mesh is so proportioned and formed that it is always self-supporting and never shielded by insulators.

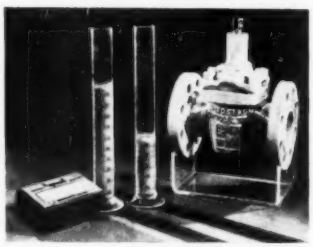
Resistors are suitable for traction service, radiant heating at "black" temperature, forced-draft heating, and where installations are subject to heavy mechanical shock.

**Exmet Electrical Corp, 59 Park Ave, New York, N.Y.**

**P1122 • LOW-WATER CUTOFF**—Non-corrosive working parts isolated from heat of float chamber features No. 63 low-water cutoff for automatically fired hot-water boilers carrying up to 50 psi.

Device is designed to stop the burner in event of low water. It uses a 1-in. equalizing pipe, a method recommended for hot-water boilers. No. 63 may also be adapted to automatically fired steam boilers in the middle range of pressures from 20 to 50 psi.

**McDonnell & Miller, Inc, 1305 Wrigley Building, Chicago 11, Ill.**



**P1118 • PLUG-VALVE LUBRICANT**—In the use of pressurized plug valves on lines carrying oil, water, gas, chemicals, slurries, etc, the one objection that engineers voice is the necessity of frequent relubrication. To eliminate this obstacle, *Hypermatic*, a new "compressible and expansible" lubricant, is said to maintain pressure and effective lubrication for prolonged periods.

The manufacturer states that if a lubricated plug valve of Nordstrom or similar type should ever spring a leak, the automatically forced-feed *Hypermatic* will instantly seal the void. Even a neglected valve, it is claimed, will remain 100% lubricated for many months. The manufacturer states that 50 to 100% more of the compressible lubricant than of the old lubricant can be inserted in the valve. Then pressure built up by turning lubricant screw is maintained for long period by elastic expansion.

Actual operating pressures range from 50 to any pressure the valve can withstand. Temperatures range from subzero to 250 F.

Graduates, in photo above, show relative

**For further data on above items use reply cards on page 184a, identifying your request with letter P and number**

H. C. FRICK COKE COMPANY'S new coal preparation plant at Robena Mine, Greene County, Pa. The ultra-modern coal cleaning equipment, complete with wiring, piping and boiler facility, at this U. S. Steel plant, was installed by Dravo Corporation. The experience of Dravo in machinery installation covers a period of more than 50 years.

# DRAVO

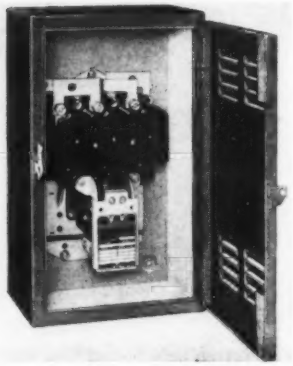
CORPORATION

DRAVO BUILDING, PITTSBURGH 22, PA.

Engineering constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations. Fabricators and erectors of power piping. Machinery installation. Power and boiler plant equipment.

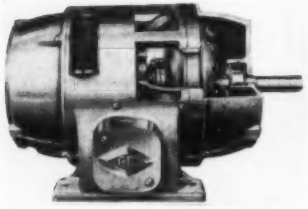
PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT

quantities of *Hypermatic* and standard lubricants, respectively, that the valve can hold.
**Rockwell Mfg Co, 400 N Lexington Ave, Pittsburgh 8, Pa.**



**P1129 • WELDER CONTACTOR**—Long life, high-speed operation for small-pot welding machines up to 10 kva, 220 v or 20 kva and 440 v, comes from use of rugged 50-amp welding contactor, Size *OW*.

High rupturing capacity is assured by two double-break contacts in series. Heavy copper bus straps allow larger welder cables to be easily connected and located for accessibility. Silver contacts provide long life and never require cleaning or dressing.
**Industrial Controller Div, Square D Co, Milwaukee 12, Wis.**



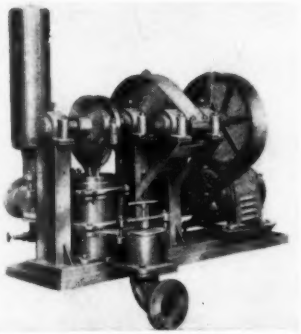
**P1104 • FLUID-SHAFT MOTORS**—Power unit combines in a single-frame an electric motor and a fluid-drive coupling. Built in all 3-phase or single-phase motor sizes from ¼ to 150 hp.

Coupling comprises the equivalent of a rotating pump and a waterwheel with the former discharging oil into the latter to drive it. A rotating vortex of oil is the only connection between driving and driven halves of the coupling. All starting and operating shocks are absorbed in the oil vortex, to give protection against jamming of equipment. At time of starting, load is practically disconnected from motor so the latter accelerates quickly and picks up load as it comes up to speed. Units are available in standard foot-mounted or round-body frames. All units can be mounted horizontally or vertically or with NEMA flange- and face-type end bells.

Motor-reducer units are also available that combine an electric motor, a fluid-drive coupling and a single or double-reduction gear in a single assembly, where low output speeds are required. All gears and bearings operate in an oil bath.
**Reuland Electric Co, Alhambra, Calif.**

**P1134 • COMBUSTION SAFEGUARD**—Gas-fired furnaces, boilers, etc, may be protected from explosion dangers during ignition, operation and shutoff with an electronic *Pyrotrol*.

If normal operation fails at any step, the lighting-up cycle stops and closes any valve that has been opened. Should the power supply go off, the entire system shuts down. *Pyrotrol* comes in six models.
**Sales Promotion Dept, Bristol Co, Waterbury 91, Conn.**

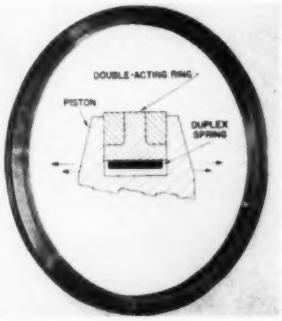


**P1116 • DIAPHRAGM PUMPS**—Motor- and engine-driven diaphragm and walking-beam plunger pumps and eccentric-driven plunger pumps handle liquids that are too heavy for self-priming centrifugal pumps, such as viscous and clotted compounds, thick residues and trash-laden liquids.

Pumps pass large quantities of bulky material, do not readily air or gas bind and operate on suction lifts as high as 20 ft. Capacities range from 50 to 250 gpm. Pumps have large ball valves guided by tapered ribs in valve chambers that are virtually clogproof.
**Marlow Pumps, Ridgewood, N.J.**

**P1147 • VALVE CONTROLLER**—*Positrol* Series 3500 valve controller is a force balance-type unit available with or without a bypass and may be used as a remote position indicator.

Valve travel can be adjusted between ¼ and 3 in. Positioner comes equipped with gages to register primary-controller, supply and control-valve-diaphragm air pressures. Bypass valve permits sending instrument air pressure direct to control-valve diaphragm. On a control valve having a 2-in. stroke, *Positrol* reproduces any one position within a maximum deviation of 0.0015 in. from its true position, says manufacturer. Air consumption with 15 psi on diaphragm is 20 standard cu ft per hr.
**Fisher Governor Co, Marshalltown, Iowa.**




**P1109 • PISTON RING**—A 3-piece piston ring is designed for steam-operated air pumps, liquid pumps, steam and air cylinders of stationary air compressors, and in air cylinders of electrically driven air compressors. Three-piece design eliminates blowby in both directions of the stroke and acts as two rings when installed.

Rings are made in three pieces, a center section that is T-shaped and two flat sections that fit into relieved sections of the T. Each of these pieces is cut into segments and the segments are doweled in position so gaps between them cannot align. The number of segments depends on size of ring.
**Hunt-Spiller Mfg Corp, 383 Dorchester Ave, South Boston 27, Mass.**

**P1166 • PANEL INSTRUMENTS**—Designated as Types *DO*-81 (direct current), *DO*-82 (thermocouple), and *DO*-83 (rectifier), these new instruments use

(*Continued on page* 164)

**For further data on above items use reply cards on page 184a, identifying your request with letter *P* and number**

Drafting Department—A special project section is maintained for the preparation of erection diagrams, field fabricating sketches, and general drafting services.

Engineering Department—Project engineers co-ordinate our field construction contract requirements and provide complete engineering services for the design of hangers, anchors and supports, stress analysis, measurements, and other engineering services incidental to construction.

Drafting Department—Here your drawing requirements are carefully analyzed and translated into details for fabrication.

*Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping throughout the world.*

*President*

# SHAW

## FOR PIPING FABRICATION SERVICE

*Plus* *

## SHAW ENGINEERING SERVICE

The supplementary service rendered customers by the Shaw engineering department is an extremely valuable one. Immediately your engineer's design drawings are received, the Shaw engineering department enlarges detail, translates plans and specifications as required for efficient handling and mutual understanding. This affords savings in time, elimination of errors, performance-ready fabrication. This "Plus" service rendered you by Shaw is just one of the many reasons for the outstanding performance record of piping pre-fabrication and installation by Shaw—and it is yours for the asking.

**BENJAMIN F. SHAW COMPANY**
2nd & Lombard Streets
Wilmington, Delaware

**KNOWN SINCE 1893 FOR HIGH QUALITY PIPING PRE-FABRICATION AND INSTALLATION**

# Take Time to Unbend

Joe Sparks, about to become a father for the fourth time, got to worrying about the Hereafter, and went to his doctor to ask how to live for a long time.

Queried the Doc: "Do you smoke?"

"No."

"Do you drink?"

"Hardly ever."

"Do you run around after women?"

"No."

"Then why the blazes do you want to live a long time?"

Most of us have at least some share of the vices, so we don't have to worry about old age on that score. But we may be forgetting something else that's more important—the building of a storehouse of happy memories to treasure 10 or 20 years from now.

A friend of mine claims there are two kinds of men: successful men and the kind who are good fathers and husbands. Oversimplified, of course, but I bet any one of us can name several acquaintances to whom the statement applies.

One man I know doesn't know what to do with himself on weekends—his job is his whole life. Another was about to crack up until someone sold him on the idea of getting a boat. Now he even takes a Saturday off so he can go fishing—and stay young in ideas.

This isn't a suggestion that we become a bunch of playboys, but everybody needs to relax once in a while. If you've waited for years to become a hot-shot photographer, now is a good time to start. If you've been thinking about that vacation cottage for 15 years, start assembling some blueprints.

I'm going to make 1950 the year to start learning the piano, 30 years after Miss Peachy Williams gave up on me and said I was the orneriest, non-piano-playing shaver she ever came across.

In other words, don't get so busy earning a living you forget how to live. That'll only lead to the day when the boys start calling you "Old Sourpuss" or "The Sad Sack"—and you'll begin to believe it yourself.

George Edwards

***Engineer***

# DOWELL

**SPECIALISTS IN SCALE AND SLUDGE REMOVAL WITH CHEMICALS**

## 800 FEET OF BURIED WATER LINE CLEANED IN 8 HOURS
## BY DOWELL CHEMICAL SCALE REMOVAL SERVICE

Dowell Service may save you important dollars by cutting out-of-service time in maintenance cleaning to a minimum. Special chemical solvents, introduced into water lines through regular valve openings, are designed to dissolve and disentegrate scale and sludge deposits *without dismantling* the line! For example, Dowell engineers were recently called in to clean 800 feet of 4" buried water line heavily scaled with three quarters to one inch of calcium carbonate. *Within eight hours, the water line was back in use with its volume increased from 45 g.p.m. at 32 lbs. to 125 g.p.m. at 24 lbs.!*

Underground or above, indoors or out, if you have a water or product line cleaning problem, call Dowell. Leading utilities, railroads and other industries have found the Dowell Service method practical, reliable and economical. Thoroughly trained Dowell engineers do the entire job, bringing all necessary chemicals and equipment to your plant in special tank trucks.

Call your nearest Dowell office today and find out about rapid, convenient, economical Dowell Chemical Scale Removal Service for heat exchange equipment, boilers, condensers, water-lines—and for increasing water well output. Free cost estimates are gladly given.

**DOWELL INCORPORATED · TULSA 3, OKLAHOMA**

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

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| Baltimore 18 | Detroit 2 | Houston 2 | Salem, Illinois |
| Wilmington 99 | Chicago 2 | New Orleans 12 | Borger, Texas |
| Richmond 19 | St. Louis 8 | Ft. Worth 2 | Midland, Texas |
| Jacksonville | Indianapolis | Shreveport 23 | Wichita Falls, Texas |
| Atlanta | Louisville | Anniston, Alabama | Lafayette, La. |

Long Beach, Oakland, Casper: Dowell Associate-International Cementers, Inc.

**DOWELL**

A SERVICE ORGANIZATION

# ENGINEER'S BOOKSHELF

**REVIEWED IN THIS ISSUE**

**THERMODYNAMIC CHARTS FOR COMBUSTION PROCESSES**
**MAINTENANCE MANUAL OF ELECTRONIC CONTROL • HYDROLOGY**
**DIRECT-CURRENT ARMATURE WINDING • WELDING AND CUTTING MANUAL**
**CONVEYORS AND RELATED EQUIPMENT • BASIC ELECTRONICS**
**DIESEL ENGINE CATALOG • REFRACTORIES**

### Electronic Control

MAINTENANCE MANUAL OF ELECTRONIC CONTROL (1949). *First edition. Edited by Robert E Miller, sales manager, Weller Manufacturing Co,* 304 *pp,* 6½x9 *in. illust, cloth.* $4.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N.Y.*

This book on maintaining industrial electronic equipment will be helpful to every electrician and electronic technician. It is a practical installation, maintenance and service manual by nine experts, covering a wide field of industrial electronics. The work is divided into nine chapters dealing with electronic-control circuits, installation and maintenance of electronic equipment, cathode-ray oscilloscope, electronic relays, photoelectric relays, electronic motor control, resistance welding control, temperature-control systems and sealed ignition rectifiers. Much of the space is devoted to installing, maintaining and servicing the equipment. At the end of each of several chapters a service chart lists the troubles that may occur in the equipment, causes of these troubles, and how to remedy them. This book takes you from the simplest electronic circuits through the more complicated ones of electric motor and welding control. It then explains use and adaptation of tools and instruments for electronic trouble shooting. Because it is free of mathematics it is suited to those with limited technical education.

### Thermodynamic Data

THERMODYNAMIC CHARTS FOR COMBUSTION PROCESSES: PART I—TEXT; PART II—CHARTS (1949). *By H C Hottel, professor of fuel engineering, G C Williams, associate professor of chemical engineering, and C N Satterfield, assistant professor of chemical engineering, all at Massachusetts Institute of Technology. Part I:* 75 *pp;* 8½x11; *cloth; illust.* $2.60. *Part II:* 23 *pp; tables;* 8 *charts;* 8½x11; *cloth.* $2.40. *John Wiley & Sons, Inc,* 440 *4th Ave, New York* 16, *N. Y.*

In studying combustion of a hydrocarbon in air an engineer does not know within narrow limits what range of temperature, pressure and composition he may encounter. These charts will help make analyses with reasonable allowance for physical realities at some sacrifice in ease of calculation. This method is vastly better than the making of simplifying assumptions that can place great doubt on the results.

These books give a series of charts for hydrocarbon-air combustion and another series of lower accuracy but broader scope covering all mixtures of carbon, hydrogen, oxygen, and nitrogen. These books give examples of cycle calculations for both the older cycles and some newer ones, including jet propulsion.

### Welding and Cutting

WELDING AND CUTTING MANUAL, 208 *pp,* 6x9, *cloth, over* 340 *illust, tables. Published by Linde Air Products Co, Union Carbide and Carbon Corp,* 30 *E* 42*nd St, New York, N.Y.*

New handbook on oxyacetylene welding and cutting process. It is a concise "how to" reference and instruction book. Step-by-step photographs accompany most of the instructions and the subjects are actual repair jobs.

The book is written primarily for repairmen, farmers, mechanics and maintenance men. It carries so many hints, shortcuts and educational material it will help any welding operator to do a better job, or a supervisor to lay out a job more readily.

There are chapters on bronze-welding, fusion welding, soldering, hard-facing, cutting steel and cast iron, heating, forming and straightening metals, welding and cutting pipe, welding nonferrous metals.

A glossary of welding terms and an appendix filled with charts and tables complete the book.

### Armature Winding

DIRECT-CURRENT ARMATURE WINDING (1949). *By Charles S Siskind, assistant professor of electrical engineering, Purdue University.* 149 *pp,* 7½x10 *in.* 106 *illust,* 10 *tables, cloth.* $3. *McGraw-Hill Book Co,* 330 *W* 42*nd St., New York* 18, *N.Y.*

Many books have been written on theory and practice of armature winding, but for clarity this is one of the best. It presents in simplified form principles of modern dc armature winding, as used for many years by the author when teaching dc machinery in vocational and engineering schools.

The approach is new in several respects. Simplified formulas are given for calculating details of several types of windings. Test procedures are described for locating troubles in windings. Problems are worked out to show how windings must be modified for changed operating characteristics.

The author stresses the similarities and differences of the various types of windings and avoids confusion by using clear-cut elementary illustrations rather than complete diagrams. Frog-leg windings, a combination of a lap and wave winding, gets extensive treatment. It is one of the more important contributions to the book. Page size permits unusually large illustrations, which add much to the clarity of presentation. Those interested in armature winding will find this book a valuable contribution to the literature on the subject.

### Conveyors

CONVEYORS AND RELATED EQUIPMENT. *By Wilbur G Hudson, ME.* 468 *pp,* 9x5¾, *cloth, tables, illust,* $7. *John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N.Y.*

Materials handling plays such an important part in industrial economy that a full-scale treatment by one of its leading proponents is very much in order.

This book has been designed as a useful working aid. It aims to develop an understanding for the student of applications as well as limitations of the various materials-handling equipment and storage methods. Yet it supplies the architect, the consultant and the plant engineer with the background to evaluate and predict equipment and its service.

There are 22 chapters plus an appendix. Chapters embrace subjects from screw and flight and apron conveyors, hoists, bucket carriers, aerial tramways, bins and bunkers to chains, drives, drive groups and motors. In addition, special chapters cover car unloading and power-plant coal and ash handling.

### Hydrology

HYDROLOGY (1949). *By C O Wisler, professor of hydraulic engineering, and E F Brater, associate professor of civil engineering, both of University of Michigan.* 419 *pp,* 5½x8½ *in.,* 132 *illust,* 29 *tables, cloth.* $6. *John Wiley & Sons,* 440-*4th Ave, New York* 16, *N.Y.*

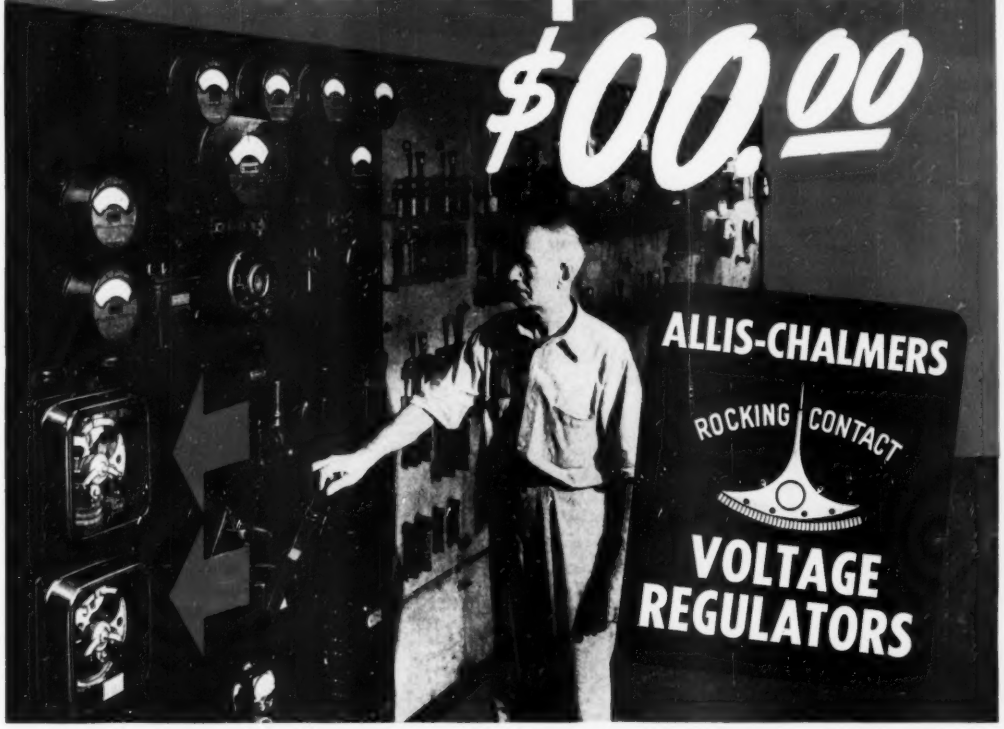
Hydrology is one of the newest of the natural sciences. It deals with the processes governing depletion and replacement of water resources of the land areas. A knowledge of hydrology is necessary in practically all problems in the use and supply of water for many purposes. It is, therefore, of value not only in the field of engineering but also in many other branches of natural science.

Fundamental principles of hydrology are presented. Included are distribution graph, unit hydrograph, theory of infiltration capacity and many other recent developments.

(*Continued on page* 160)

# 15 Year Repair Bill—

# $00.00




FIFTEEN YEARS OF CONTINUOUS SERVICE controlling constant generator voltage for a large municipal sanitarium — not one dollar spent for maintenance — and still no sign of needed attention . . . That's the record of these Allis-Chalmers Rocking Contact Generator Voltage Regulators!

It's the kind of proven dependability and low maintenance you can get with Rocking Contact Regulators. These units have no vibrating contacts and no gliding friction . . . no complex adjustments to make — *simplicity* that means years of trouble-free service for you.

And they are precision built for *Instant Response* and *Accuracy*. Contact sectors are supported in jeweled bearings . . . rock on carefully machined commutator segments heavily plated with silver for reliable, long-life accuracy.

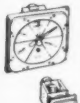
Rocking Contact Voltage Regulators are available for both a-c and d-c generators of any size and speed, for either paralled operation or unit control. Write direct for recommendations, or call your nearby A-C office.

A-2797

**ALLIS-CHALMERS, 952A SO. 70 ST. MILWAUKEE, WIS.**

**OTHER ALLIS-CHALMERS SPECIAL CONTROL**

**SYNCHRO-OPERATOR** — Automatically synchronizes alternating current generators, tie lines, synchronous condensers, etc.



**D.C. POSITIONER** — Operates from power plant d-c bus, used for remote indication, control, order telegraph, etc.

**REGULEX CONTROL** — Used where the features of a rotating type regulator are desired.

*Regulex* is an Allis-Chalmers trademark.

# ALLIS-CHALMERS

***Pioneers in Power and Electrical Equipment from Generation through Utilization***

# CORRECT DRAINAGE
## at all operating pressures

● Stickle Steam Traps, available in designs to meet specific conditions of operation, and in capacities for required volume.

**STICKLE SERIES 100**

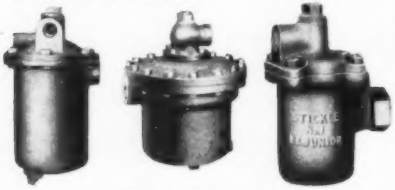
A series of traps with a capacity range of 250 to 4,500 lbs. per hour for drainage of smaller units operating at low, medium and high pressures. Built for straight-in-line installation. See Bulletin No. 115.

**STICKLE SERIES AE**

A series of traps with a capacity range of 4,500 to 18,000 lbs. per hour for drainage of larger units operating at medium and high pressures. Multiplies old standard capacities by four. See Bulletin No. 315.

**STICKLE SERIES 50**

This series of Stickle Traps especially designed for drainage of processing units operating at medium to high pressures creating unusually large volumes of condensate. Capacity standard 8 to 10 times that of standard traps. Capacity range 18,000 to 45,000 lbs. per hour. See Bulletin No. 515.



**STICKLE SERIES T**

A series of traps for drainage of units working at medium and low pressures and to work with vacuum systems. 12 styles and sizes afford a wide range of adaptations and meet a wide range of requirements. See Bulletin No. 415.

**STICKLE OPEN FLOAT STEAM TRAPS**

The Stickle Open Float principle of construction is adapted for drainage of equipment operating at high pressures, medium pressures, low pressures or with vacuum systems. Stickle Open Float is both simple and positive, supplying a natural operation that is thoroughly efficient and completely effective.

**NO MECHANICAL DIFFICULTIES**

The Stickle Open Float avoids complicated construction. Stickle traps open and discharge when the Open Float loses buoyance and opens valve; they close when the Open Float regains buoyance and closes valve. Both actions are instantaneous. The movement, up or down, is slight. There is no friction, no sticking. There are no levers or hinges—no unnecessary mechanical parts. Air and gases are discharged with condensate.

**EFFICIENT DRAINAGE—LONG SERVICE LIFE**

The installation of Stickle Steam Traps means complete drainage efficiency—and dependable service with long life. Stickle Traps supply better drainage. Better drainage improves production and reduces costs.

**OTHER STICKLE EQUIPMENT**

**Stickle Reducing and Regulating Valves. Single seat, balanced, and double seat, semi-balanced series. *Bulletin No. 235 and No. 435.* Stickle Differential Drainage and Boiler Return Systems. Return condensate to boilers, under pressure with low B. T. U. loss. *Bulletin No. 250.* Stickle Open Coil Feed Water Heaters and Purifiers. *Bulletin No. 117.***

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**STICKLE EQUIPMENT**

STICKLE DIFFERENTIAL AND BOILER RETURN SYSTEMS • STICKLE OPEN FLOAT STEAM TRAPS • STICKLE REGULATING AND REDUCING VALVES • STICKLE OPEN COIL FEED WATER HEATERS AND PURIFIERS • STICKLE OIL AND STEAM SEPARATORS STICKLE TEMPERATURE CONTROLLERS AND OTHER SPECIALTIES


## ELECTRONICS

(*Continued from page* 118)

minus bias on tube $E_1$ to cause its output voltage to decrease as a wave *CDE*, Fig. 4. The reverse of this occurred when input voltage reversed, like curve $C_2D_2E_2$, on tube *E* grid. Only when input voltage changes does the capacitor cause a current flow.

We have seen how capacitor $C_2$ serves the dual purpose of blocking the flow of dc between the two stages while passing ac. This prevents normal changes of *dc* voltage of the first stage from being amplified in the second stage. Even though a source of anode potential were used in each stage, Fig. 6, the capacitor would permit using a single source for both stages, as is done in some commercial circuits.

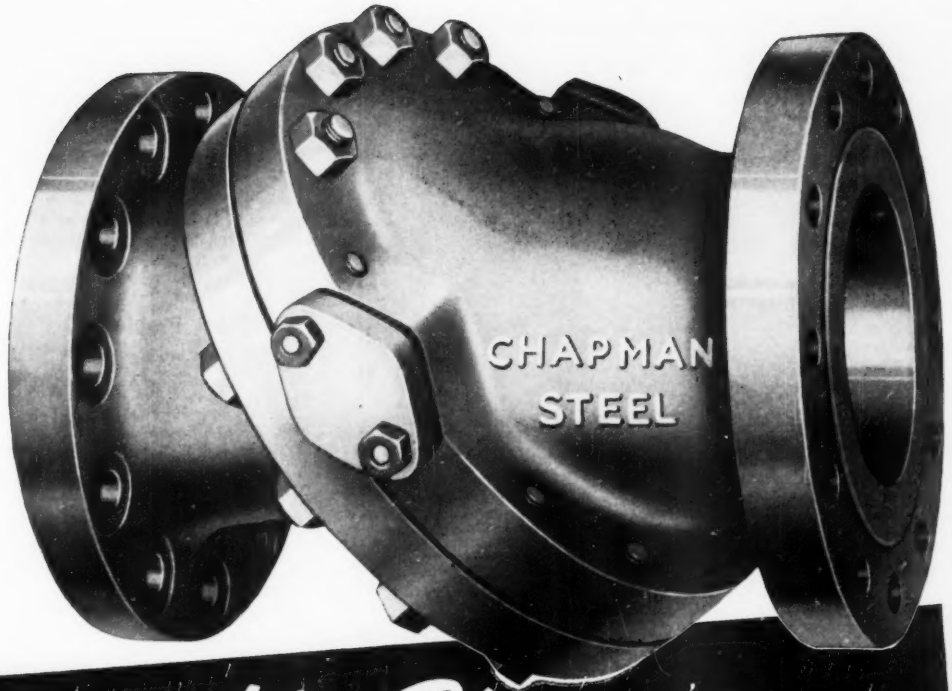
**Push-Pull Amplifiers.** Fig. 7 and 8 show two tubes, connected in a push-pull amplifier, used where comparatively large power output is required. In industrial electronic applications this circuit is often used with thyratrons. To simplify our study, vacuum tubes are used here. Connections are such that when the input signal decreases the bias on one tube, bias on the other is increased.

Assume the input circuit dead in Fig. 7. Then transformer *T* does not have voltage induced in it. Battery *C*, however, puts a bias on the grid of each tube. This bias is applied from – on the battery through each half of transformer *T* secondary winding to the grid, the cathode, back to + on battery *C*.

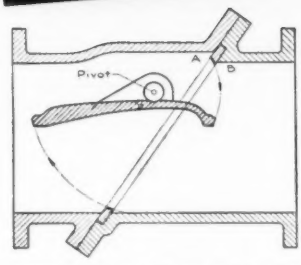
**Bias Blocks Tubes.** For simplicity we can assume that this bias just blocks the tubes, to prevent current flowing through them or transformer $T_1$. If an ac voltage is applied to transformer *T* primary of a polarity shown, Fig. 8, it will induce a voltage in the secondary. The induced voltage opposed battery *C* voltage in the top half of the winding and is in series with it in the lower half, as indicated by the arrows.

As a result bias of tube *E* decreases and increases on tube $E_2$. This action permits tube *E* to conduct, while further blocking tube $E_2$. Current now flows from – on battery *B* through tube *E* and the top half of transformer $T_1$ primary winding, as the arrows show. As our study of Fig. 1 to 6 showed, when an ac wave is impressed on the grid the resultant amplified output voltage is also *ac*. This voltage applied to the top half of transformer $T_1$ induces an ac output voltage in the secondary.

When the input voltage reverses, induced voltage in transformer *T* secondary is reversed. This will increase the bias on tube *E* to block it and reduce tube $E_2$ bias by a like amount, so this tube conducts. Lower half of $T_1$ transformer primary is now energized to




# THERE IS *No Slamming* WITH CHAPMAN TILTING DISC CHECK VALVES




Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

BECAUSE of the design of the balanced hinge-pinned disc, Chapman Tilting Disc Check Valves always close smoothly and quietly. There is no slamming, no hammering, no destructive pipe-line stress.

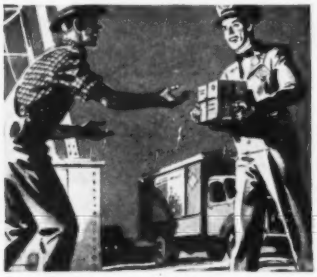
When open, the disc rides smoothly in the flow. As it closes, the effect of the stream on the short flap cushions the contact with the body seat. There is no sliding action and therefore wear on seats is reduced to a minimum. In addition, head losses are lowered as much as 65% to 80% over those experienced with conventional type check valves.

Available in either iron or steel.

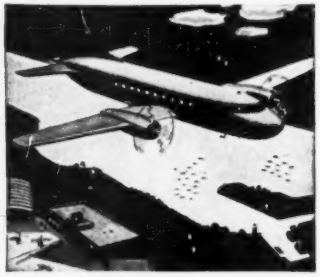
**The Chapman Valve Mfg. Co.**
**INDIAN ORCHARD, MASS.**

## $3.19 Air Express cost helped this wildcatter strike it rich!

**When a pump valve** goes while drilling for oil, it's costly. Idle men and equipment make profits evaporate. It happened to a wildcatter at 4 P.M. Phoned 800 miles away for parts—delivered 11 P.M. that night by Air Express. 12 lbs. cost only $3.19. (*Regular* use of Air Express keeps *any* business moving.)



**$3.19** was *complete* cost. Air Express charges include speedy pick-up and delivery service. Receipt for shipment too. Makes the *world's fastest* shipping service exceptionally convenient.



**Air Express** goes on all Scheduled Airline flights. Frequent schedules—coast-to-coast overnight deliveries. Direct by air to 1300 cities, fastest air-rail to 22,000 off-airline offices.

### Facts on low Air Express rates

Special dies (28 lbs.) go 500 miles for $4.30.
6-lb. carton of vacuum tubes goes 900 miles for $2.10.
(*Same day* delivery if you ship early.)

**Only Air Express gives you all these advantages:** Special pick-up and delivery at no extra cost. You get a receipt for every shipment and delivery is proved by signature of consignee. One-carrier responsibility. Assured protection, too—valuation coverage up to $50 without extra charge. Practically no limitation on size or weight. For fast shipping action, phone Air Express Division, Railway Express Agency. And specify "Air Express delivery" on orders.

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give an output voltage opposite to that shown in Fig. 8. In this way any input voltage change impressed on the primary of transformer $T$ is reproduced in amplified form in the secondary of transformer $T_1$.

We now have some more tools to work with, which we will apply in following articles on smoke-density indicators and recorders and flame-failure protective devices. The next article will deal with voltage regulators for electronic circuits.

## Plant Problems

(*Continued from page* 126)

$Ry_2$. This will open the connected ocb. It is customary to have ground fault relays installed on feeder ocb's and set at a lower tripping value than the generator ground fault relays.

G O ELLIOTT *Ontario, Canada*

## Small Plants Ungrounded

HERE ARE two reasons for grounding generator neutrals.

One is to limit the voltage between line and ground that may be impressed on the insulation. This may be understood since if neutral is ungrounded and an accidental ground occurs, machine insulation has line-to-line voltage impressed on it.

The other reason is to insure equipment will trip out through relay operation if accidentally grounded. Grounding is generally undesirable in small plants with few feeders and where continuous service is essential. All our sewage plants, generating at 4160-v, have Y-connected ungrounded generators.

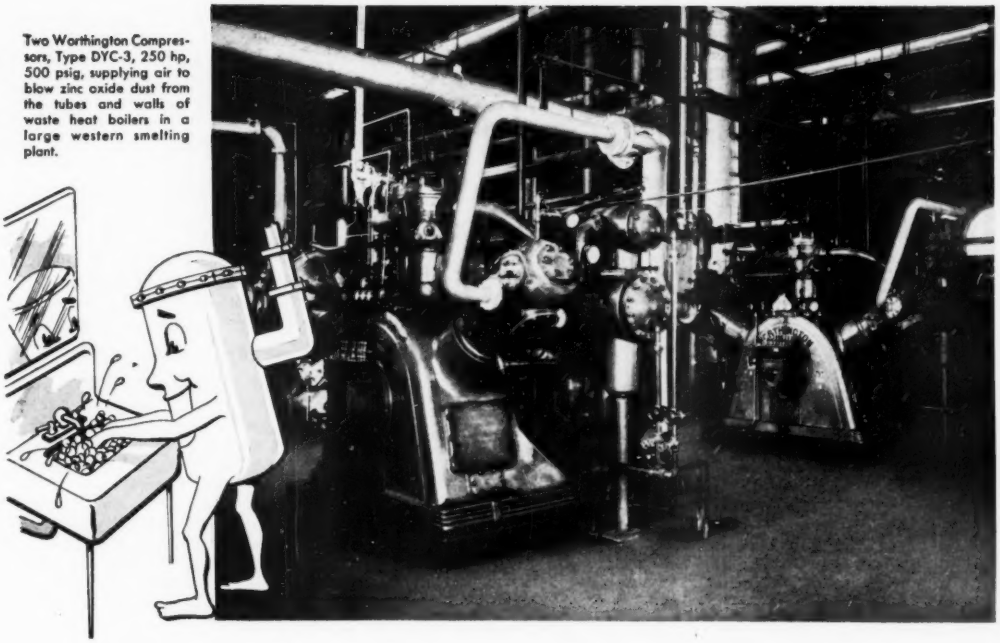
F J ARDALINO *Brooklyn, N. Y.*

## Advantages of Both Plans

DR RAISES an interesting problem. Grounded neutral vs ungrounded neutral electrical systems in industrial plants cannot be answered arbitrarily one way or another. Each industrial plant must be analyzed separately. An isolated system would receive a different treatment from a plant interconnected with other systems.

In general, on ungrounded systems the insulation of all associated connections and equipment is susceptible to high voltage stresses during any electrical disturbance. To insure against insulation failure on an ungrounded system calls for equipment with a higher insulation level.

With a grounded neutral system excessive current flows under fault conditions. But with proper relay and breaker protection the circuit will be opened quickly under fault conditions. Service



Two Worthington Compressors, Type DYC-3, 250 hp, 500 psig, supplying air to blow zinc oxide dust from the tubes and walls of waste heat boilers in a large western smelting plant.

# *Here's Your Modern, Money-Saving Way To Make Boilers "Come Clean"!*

**Worthington Compressors Do A Real Job Of Soot Blowing... Faster, Better, At Less Cost!**

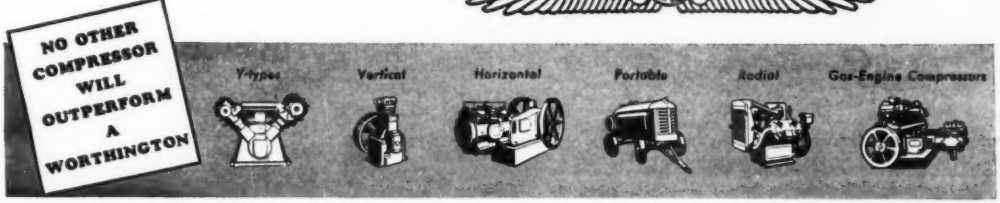
Boiler cleaning by hand is a messy, makeshift carry-over from the horse-and-buggy era. Today, soot-blowing by compressed air is an economic necessity. Originally developed for low pressure boilers, air soot blowing has shown so many advantages over steam as a cleaning agent that its use has now extended to central stations and big power plants throughout the nation.

The reasons are plain. Air soot blowing saves fuel and feed-water make-up, while lessening the possibility of tube erosion. It uses inexpensive, low-temperature piping, with piping insulation eliminated. It reduces soot blower maintenance, provides a dryer blowing medium and a more effective means of slag removal. Finally, its complete adaptability to automatic control reduces costly manual operation throughout long years of service.

**"Heart" Of Every Soot Blowing System**

is its compressors . . . and Worthington builds these for every application . . . builds them to give you longer, quieter, smoother service — and air at lower cost. For further facts proving *there's more worth in Worthington*, write for booklet, "Worthington Compressors for Soot Blowing". *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.* K9-3

**WORTHINGTON**

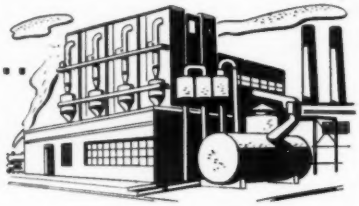


CORAVOL CASE HISTORY NO. 7

7th in a series describing CORAVOL results in steam systems

Type of Operation...

CHEMICAL MANUFACTURING PLANT



OPERATING CONDITIONS: Evaporation—400,000 lbs. per 24 hours.
Make-up—50% and over.
250 psi operating pressure.

PROBLEM: 5 to 6 parts per million of free carbon dioxide in condensed steam resulted in a pH below 6.0. The low pH produced a corrosive condensate which caused considerable trouble in return lines.

CORAVOL STARTED: July 1947.

RESULTS: pH maintained at substantially above 7.0. Corrosion arrested or greatly retarded.

USER COMMENTS: "We have found that condensate lines have been well protected by CORAVOL."

CORAVOL (the original* AMINE PROCESS)

SAVES YOU COSTLY PIPE REPAIRS, REPLACEMENTS, MAINTENANCE LABOR, HOURS and DAYS OF SHUTDOWN LOSS

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special formulas of chemical treatment for: boiler feed water . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . soot removal

CORAVOL in your steam system (1) prevents corrosion in lines, (2) cleans out clogging rust deposits. Thus, CORAVOL *protects lines;* improves heat transfer; restores original capacity of lines and efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because CORAVOL volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

*The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

WRITE TODAY for complete *free* data about the CORAVOL process.

WESTERN CHEMICAL COMPANY

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interruptions under these conditions are only temporary.

Another factor that must be considered is the generation of a third harmonic in the voltage wave of a 3-phase generator. To reduce the third harmonic, generators are Y-connected. When neutrals are grounded and two Y-connected generators are operated in parallel, a circulating current will flow between the two units. To prevent this interchange of current via the neutral only one generator is grounded at a time during parallel operation.

K B HOFFMAN *Tenafly, N. J.*

## Reactor in Neutral Lead

THE QUESTION raised by *DR* confronts almost every industrial electrical engineer. And it is one for which there is no complete answer since both grounded and ungrounded neutral systems have advantages and disadvantages.

We had occasion to go into this matter rather exhaustively several years ago in connection with operation of our own generating plants. We weighed advantage of the ungrounded neutral system, being able to operate with an accidental ground on one phase without tripping a breaker, against the danger of excessive potentials on phase wires to ground caused by lightning or switching surges. Our conclusion was that for voltages of 5 kv or over it was better to build the system with a high factor of safety in insulation, provide adequate surge protection, and ground the neutral—not solidly, but through a reactor. The latter would limit the maximum single-phase fault to the same value as the maximum 3-phase fault current. With this arrangement all advantages of the solidly grounded neutral system are obtained, that is, reduction in system insulation level and the lightning arrester ratings, full differential protection for generators, use of ground fault relays for clearing grounded feeders, etc.

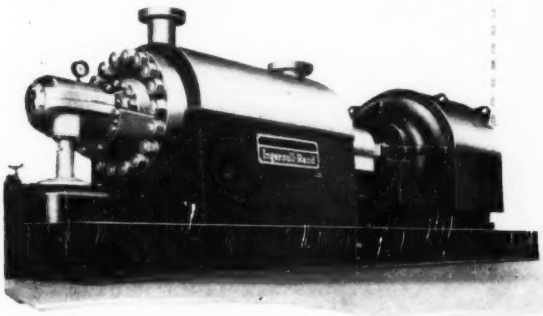
A reactor was chosen in preference to a resistor because it avoids the heavy load thrown on the prime mover, which is the case when a ground fault occurs on a resistance-grounded system. Our experience over the past five years or more seems to prove our decision was a wise one, since tripouts of feeder breakers from ground faults have been infrequent and not at all troublesome. At the same time we have had no equipment losses from lightning or other surge voltages.

R T WOODRUFF *St. Louis, Mo.*

## Must Have All Facts

DR'S QUESTION on the merits of grounding of generator neutrals is one on which volumes have been written. It is not always a case of ground or no

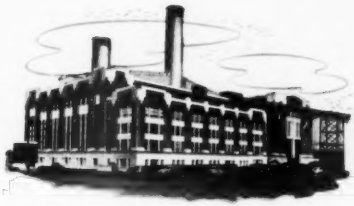
# HERE'S WHY
# Ingersoll-Rand
# BOILER-FEED PUMPS
# are
# FIRST CHOICE
# for really
# HIGH PRESSURES



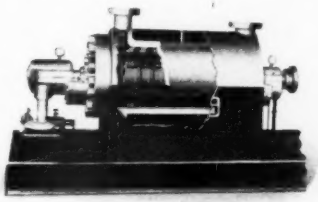
When so many leading Central Stations repeatedly specify Ingersoll-Rand boiler-feed pumps for the highest operating pressures in use today, you can be sure there are good reasons for this preference. Here are three of them—*dependability, ease of maintenance,* and *appearance*—all important considerations in the modern, high-pressure steam generating plant.

I-R high-pressure boiler-feed pumps, Class CHTA and CHTB, are multi-stage, single-suction, diffusor-type units, built for discharge pressures of from 1000 to 3000 psi—in capacities to 2800 gpm at temperatures up to 800° F. But *whatever* pressure or capacity you need, Ingersoll-Rand can supply a boiler-feed pump for the job. I-R engineers will be glad to help you select the pump that best meets all of your specific requirements.

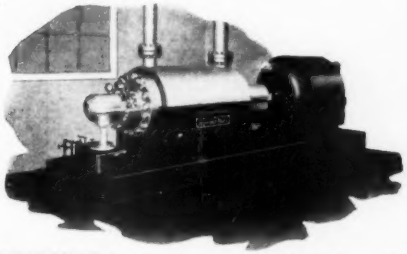
***FOR COMPLETE** information on Class CHTA and CHTB high-pressure boiler-feed pumps call the nearest Ingersoll-Rand branch office. Ingersoll-Rand manufactures all types and sizes of centrifugal pumps.*



**DEPENDABILITY** is probably the most important single requirement in all central station equipment. And here, I-R double-case boiler-feed pumps have chalked up a record that speaks for itself. Many of these high-pressure units have been in service for over 12 years—with little or no attention! And more than 40% of the units sold are on *repeat* orders—from users who have already proved this dependability in their own plants.



**EASIER MAINTENANCE,** and less of it, is an inherent feature of the new I-R Class CHTA and CHTB pumps. They are of "double-case" construction which permits maximum accessibility and greatly simplifies regular maintenance procedure. You save hours, or even days of "down-time" on dismantling and assembly operations too, because the entire inner casing assembly can be removed as a unit in a surprisingly short time.



**APPEARANCE** is becoming an increasingly important factor in the modern Central Station. And the sleek, streamlined design of I-R boiler-feed pumps is entirely in keeping with the trend in modern equipment. Many of the lubricating system components have been integrated into one compact assembly, thus eliminating much external piping. Sheet metal lagging over the casing blends in with the main pump support.

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**Two Bronze Seats** give top protection against the pitting action of electrolysis and the corrosive effects of bad water, oils, etc.

**Air-Refined Malleable Iron** in body and nut ensures highest resistance to stress and stretching . . . gives you a *practically indestructible union.*

**Extra-Heavy Shoulders** are built to take the toughest wrench abuse through many a reinstallation.

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**PROVIDENCE 5, RHODE ISLAND**

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ground, but rather, How can grounding be best accomplished if used? This can be done by so-called solid grounding, reactor or resistance grounding, and other methods. The distribution system must also be considered.

Several generalizations may, however, be made on this question. It is probably true that ungrounded generators will have fewer outages than any other type of system. This is because with the lack of adequate ground relaying, circuits are not automatically tripped out when a ground occurs. In the event of a ground, some type of ground detector must be relied upon to indicate that a ground exists on the system. For this reason, where continuity of service is vital, the ungrounded operating method is used.

Disadvantages are also inherent in the ungrounded system. When a ground occurs, it is not localized, but is transmitted to all parts of the system. Sometimes this results in considerable neutral shift with a resultant high voltage on the ungrounded phases. Arcing grounds may occur with the ungrounded system. In addition, double faults have been known to occur because of above-mentioned high voltage. Hence, when the high voltage is impressed on the ungrounded phases an insulation failure may result in a second phase grounding.

One big disadvantage of solid grounding is that phase-to-ground fault currents may exceed 3-phase fault currents, for which the generator has been designed. This can cause mechanical stresses in the generator, which will be greater than design strength. In cases of this sort it is necessary to ground the neutral through a reactor or resistance, which will limit the current to a value below or equal to 3-phase fault current. This same idea must be followed when determining interrupting capacity of breakers.

Operating procedure is generally simple in either grounded or ungrounded systems. But in the ungrounded system the possibility of a double fault may cause complications in time of trouble. The grounded system, with adequate relaying, will be automatically cleared by the opening of breakers to localize trouble.

In determining type of system to be used, there is also the matter of size and cost of equipment necessary. This, of course, is a design problem, which is generally thrashed out only when a new system or addition to an existing system is contemplated.

W G Weeks *Arlington, N. J.*

## Grounding Removes Static

Principal advantage of a uns (ungrounded neutral system) is its ability in some cases to clear ground faults

# How the Alchlor Process makes GULFCREST a superior turbine oil —

1. The Alchlor Process is an extra refining step—weeds out more sludge-forming hydrocarbons than any other refining method.

2. The Alchlor Process imparts a greater ability to benefit from special inhibitors that control oxidation and prevent corrosion.

3. Result: An outstanding oil with long life and unmatched performance records.

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In Cylinder 2 you see the part—approximately 15% — discarded by the Alchlor Process. This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and harmful acids.

In Cylinder 3 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps you keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it—they give it still greater stability and protect against corrosion.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

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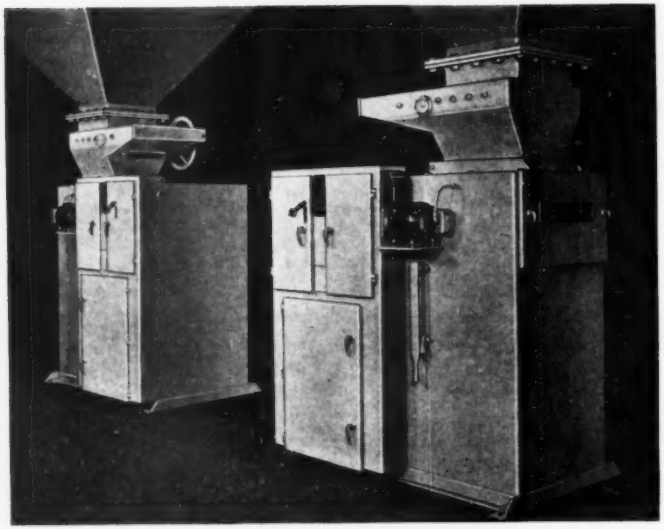

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S-E-Co. Perfect By-Pass is just one of the many features included in S-E-Co. Scales that make them particularly suitable for your use.

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**STOCK ENGINEERING COMPANY**

**715P Hanna Building • Cleveland 15, Ohio**

without interrupting the whole system. This effect is one of probability, but completely satisfactory results cannot be secured above 100 miles of 11-kv circuits. On total circuits length of this order or lower, the uns will probably have fewer trip-outs than any form of gns (grounded neutral system).

Uns is not likely to induce high voltages in neighboring communication circuits since ground-fault currents are ordinarily low. To avoid a complete outage in a uns, it is necessary to clear any fault as speedily as possible. Otherwise, a fault occurring in either of the other phases will completely disrupt the system.

When two generators are operated in parallel there is the possibility of circulating harmonic currents. Harmonic currents circulating in neutral may be larger than the line currents. Suppose two equal 3-phase Y-connected generators in parallel, interconnected neutrals, become displaced in phase. Phase displacement may be produced as hunting, by a sudden change in load or by careless synchronizing. As a result there is a triple-frequency current in each phase. Trouble caused by this triple-frequency current is due not so much to the increase in the armature copper loss as it is to the tripping out of the circuit breakers of slow-speed alternators that may have a large short-circuit ratio. This trouble can be avoided by grounding each alternator through a low resistance or reactance and by grounding only one of two alternators in parallel.

Use of lightning arresters on a gns is somewhat more difficult than on a uns. Standard arresters for solidly grounded systems are rated at about 80% of the normal line-to-line voltage. Instead, uns have their lightning arresters rated about 100% of normal line-to-line voltage.

On uns, selective relaying on ground faults is practically impossible for short line lengths. Hence, detection and isolation of fault lines is likely to be quite long. If the circuits are long enough to give sufficient fault current for relaying, then the self-clearing advantage is lost and the system may as well be grounded. Grounding through resistance immediately disposes of two defects of the gns. It permits ready relaying of ground faults and it minimizes hazard of arcing grounds. In general, the grounding resistances used limit the ground-fault current to less than 3-phase short-circuit current.

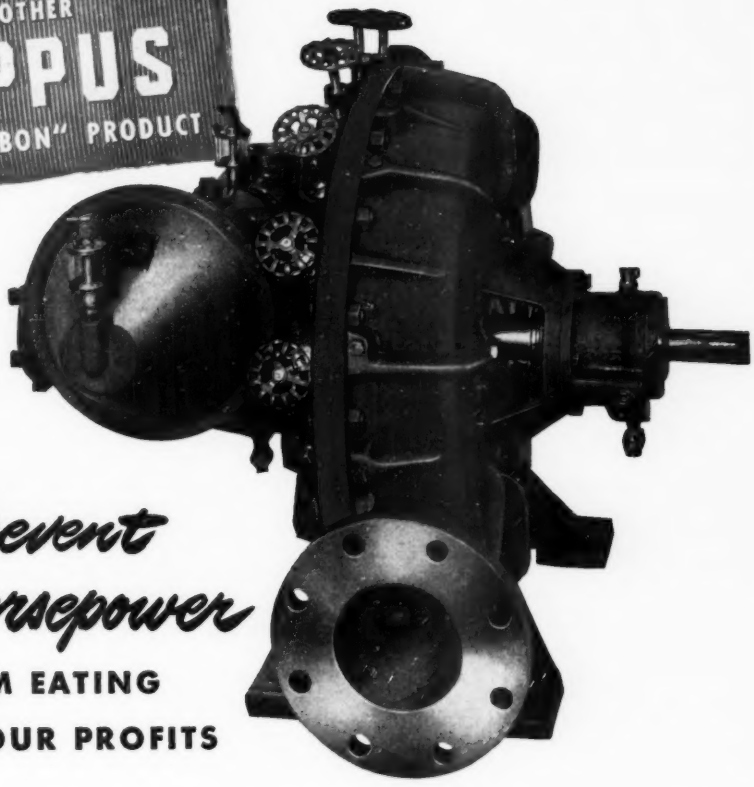
Gns makes possible protection of the generators against internal faults by differential relay protection. Gns offers a low-resistance path to ground, thereby preventing accumulation of electrostatic charges.

JORGE M RIVAS *Buenos Aires*

ANOTHER

# COPPUS

"BLUE RIBBON" PRODUCT



## *Prevent Idle Horsepower*

**FROM EATING**

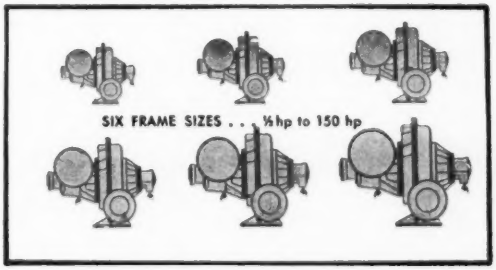
**INTO YOUR PROFITS**

Paying for a larger turbine than you need is a waste of money you can easily avoid. Coppus "Blue Ribbon" Turbines are designed to meet small-power requirements exactly. Made in six frame sizes — fractional to 150 hp, and priced accordingly — they're hard-working, smooth-running, always dependable... the logical, economical drives for your pumps, blowers, fans and similar equipment.

Coppus precision-builds these rugged performers, checks their close tolerances with Johansson blocks, gives each a thorough dynamometer test before shipment. That's why you can count on them for the cost-saving efficiency built into all Coppus "Blue Ribbon" products — blowers, ventilators, gas burners, etc.

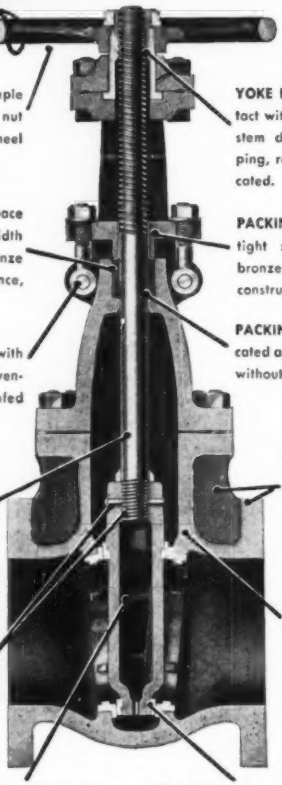
Since 1937, over 85% of all orders for Coppus Turbines have been repeat orders. Add their rapidly increasing use on top-name original equipment and you have conclusive proof of their ability to make good on the job — *your* job.

Send for Bulletin 135-10 COPPUS ENGINEERING CORPORATION, 171 Park Avenue, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.



# Precision Engineering Makes this KENNEDY VALVE Rugged and Dependable . . .

**KENNEDY STANDARD IRON BODY WEDGE GATE VALVE**
**Fig. 0611, outside-screw-and-yoke. Service up to 125 lb. p.s.i. steam; 200 lb. p.s.i. water, oil or gas. 1½" through 48" sizes available.**



**HANDWHEEL,** large, for ample leverage . . . secured to yoke nut by large bronze, hexagonal wheel nut, readily removable.

**STUFFING BOX,** packing space depth is more than 4 times width for longer packing life. Bronze bushed for corrosion resistance, durability.

**BOLTS,** swing eye type with washer nuts, for greater convenience in repacking. Rust-proofed to prevent corrosion.

**STEM,** rolled bronze, liberal diameter, for high tensile and torsional strength. Top seat collar permits repacking under pressure.

**STEM AND DISC** threaded together, prevented from turning by nickel copper alloy pin with ends riveted over.

**WEDGE DISC,** reversible and interchangeable, reinforced by integrally cast interior posts. Openings permit drainage in any position.

**YOKE NUT,** bronze, thread contact with stem at least 1½ times stem diameter eliminates stripping, reduces wear, easily lubricated.

**PACKING GLAND** machined for tight seal with stuffing box, bronze-bushed at stem. Slotted construction simplifies repacking.

**PACKING,** molded rings of lubricated asbestos maintain tightness without excessive gland pressure.

**FLANGES** are heavy and well filleted. Flanged ends have reinforcing ribs for extra strength.

**BODY AND BONNET,** Kennedy Higher Strength Cast Iron, generous metal thicknesses and well rounded corners provide maximum strength.

**DISC RINGS,** bronze, wide and thick, forced into dove-tailed grooves in disc to form practically integral construction.

*Write for* ***Bulletin No. 50. BUY FROM YOUR LOCAL DISTRIBUTOR***

THE **KENNEDY** VALVE MFG. CO.
1060 EAST WATER ST.
ELMIRA, NEW YORK
VALVES · PIPE FITTINGS · FIRE HYDRANTS

OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO · SALES REPRESENTATIVES IN PRINCIPAL CITIES


## Engineer's Bookshelf

(*Continued from page* 148)

Valuable for solving practical problems in hydrology, the book provides information to determine maximum flood flow that may be expected, as in drainage and storm-sewer design. For the design of spillways in dams or other flood-control works, methods are given for determining maximum flow that will occur at rare intervals, as, for instance, once in a thousand years.

The many practical applications make the book useful to the general practicing engineer, forester and agriculturist, as well as to the student interested in basic principles of hydrology.

BASIC ELECTRONICS (1949) *By R G Kloeffler, head, electrical engineering department, Kansas State College, and M W Horrell, supervising engineer, research laboratories, Bendix Aviation Corp.* 435 *pp,* 6x9 *in., illust, cloth.* $5. *John Wiley & Sons,* 440-4*th Ave, New York* 16, *N.Y.*

Even though written for a first course in college electronics, practicing engineers and electronic workers will find a large part of the book suited to their purpose. Its scope is broad enough to cover the special interests of both power and communication workers. In a complete and easily understood manner, the first chapter covers physical concepts of atomic structures and electric current flow. These concepts lay the foundation for understanding the operation of electron tubes and circuits.

Other chapters cover electron emission, vacuum diodes, grid-controlled vacuum tubes, vacuum-tube amplifiers, multistage voltage amplifiers, power amplifiers, electron-tube oscillators, electrical conduction in gases, gaseous and vapor electron tubes, crystal and metallic rectifiers, photoelectricity, special photo applications and special tubes and circuits. About every generally used electronic device has been included, even to such recent ones as the mechano-electronic transducer and the transistor. Because of this alone the book is an excellent reference source. It also covers a wide range of electronic circuits.

DIESEL ENGINE CATALOG (Volume 14). 378 *pp,* 10½x13½ *in., tables, illust,* $10. *Published by Diesel Engines, Inc, 2 West* 45*th St, New York* 19, *N. Y.*

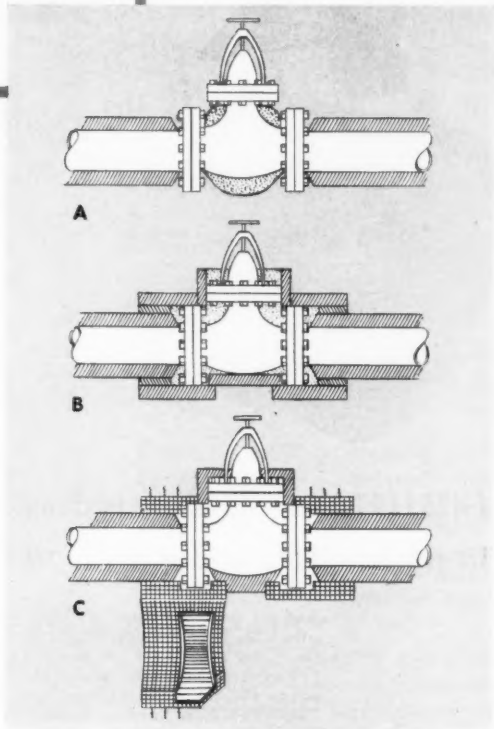
This annual reference volume follows the pattern established in former years. The major section, of some 200 pages, describes and illustrates the current models produced by American engine builders. For each manufacturer there is a summary in tabular form listing model numbers, cycle, hp, speed, cylinder dimensions, fuel system and starting method.

In a second section, of some 40 pages, are illustrated descriptions of accessories, including: valve adjusters, fuel-injection equipment, superchargers, cooling equipment, torque converters and mechanical transmission equipment.

At the end of the advertising section there is a directory of makers of diesel engines and accessories and an index of manufacturers.

Engineers concerned with purchase and maintenance of diesels and their accessories

# How would you insulate this valve?




**High pressure process steam passes through a number of flanged valves in a 6" line. Which, in your opinion, is the most practical method of handling insulation of the valves?**

- ☐ **A.** Leave flanges bare, just insulate valve bodies
- ☐ **B.** Cover flanges permanently
- ☐ **C.** Use removable and replaceable flange covers

## Here's what the Armstrong Engineer recommended:

Before making a decision of this kind, it is first necessary to know the cost of steam, and whether or not the flanges must be readily accessible. If steam costs are low, and the valves are likely to need frequent reseating or renewal, it is probably best to use method **A**. If steam costs are high, and maintenance of valves negligible, the permanent covers are recommended. Finally, where valves must be readily accessible, and where fuel costs are high, the use of removable covers will be most economical in the long run.

Armstrong engineers have found that every job offers many problems that must be well thought out if the insulation is to give full value for every dollar spent. They're ready to help you write insulation specifications tailored to your individual job requirements. The methods they recommend will be carried out with top-quality materials, applied by skilled mechanics. The next time you are considering heat insulation, take the time to outline your problem to the Armstrong engineer. He can help make your job a better one.

**FREE BOOKLET**

**Write today for 28-page booklet, "Armstrong's Industrial Insulations." It contains a chart listing types and thicknesses of insulation for all temperatures. Armstrong Cork Company, 7011 Maple Avenue, Lancaster, Penna.**

**ARMSTRONG'S INDUSTRIAL INSULATIONS**

MATERIALS (A) INSTALLATION

FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2800° F.

**CHESTERTON "64" packing retains its compressibility even at high temperatures**

You get more "take-ups" and fewer repacking jobs with "64", because diagonally laid asbestos cloth plies have greater resilience than "parallel to the rod" packings. For steam up to 400 p.s.i., superheated and hot gases, CHESTERTON "64" is made with a new binder which resists hardening and assures full gland take-up as wear takes place. We will be glad to send you a catalog on request describing the construction of "64" and 110 other styles of CHESTERTON's truly fine packings.

Because CHESTERTON "64" is *not* loaded with common rubber cement, it weighs 25% less per foot than ordinary packings. As you buy by the pound, but use by the foot, "64" will save you many dollars yearly in its lighter weight alone. "64" will prove the most satisfactory packing you have ever used for high pressure steam rod service. Order CHESTERTON "64" today direct or from your local jobber and experience a brand new packing satisfaction.

**PACKS 25% More Rods per Pound of Packing**

**"64" is one of 111 outstanding Chesterton Styles**

PACKING
Chesterton
SERVICE
**A. W. CHESTERTON CO.**

*Established 1884*

**6 ASHLAND ST. EVERETT 49, MASS.**

will find this a handy reference, giving, in one volume, a broad cross-section of the industry.

REFRACTORIES. 272 *pp*, 8½x11 *in., tables, illust, cloth.* $5. *Published by General Refractories Co, Philadelphia, Pa.*

Intended to serve those who design, use, purchase, construct and operate equipment requiring refractory materials, this handbook covers all phases of modern practice in this field.

It begins with a brief history of refractory materials, and of the General Refractories Co. Following chapters describe the manufacture of refractory brick, uses of refractories in industry and factors involved in selection. The General Refractory Co complete line of refractory brick, mortars, plastics and castables is presented.

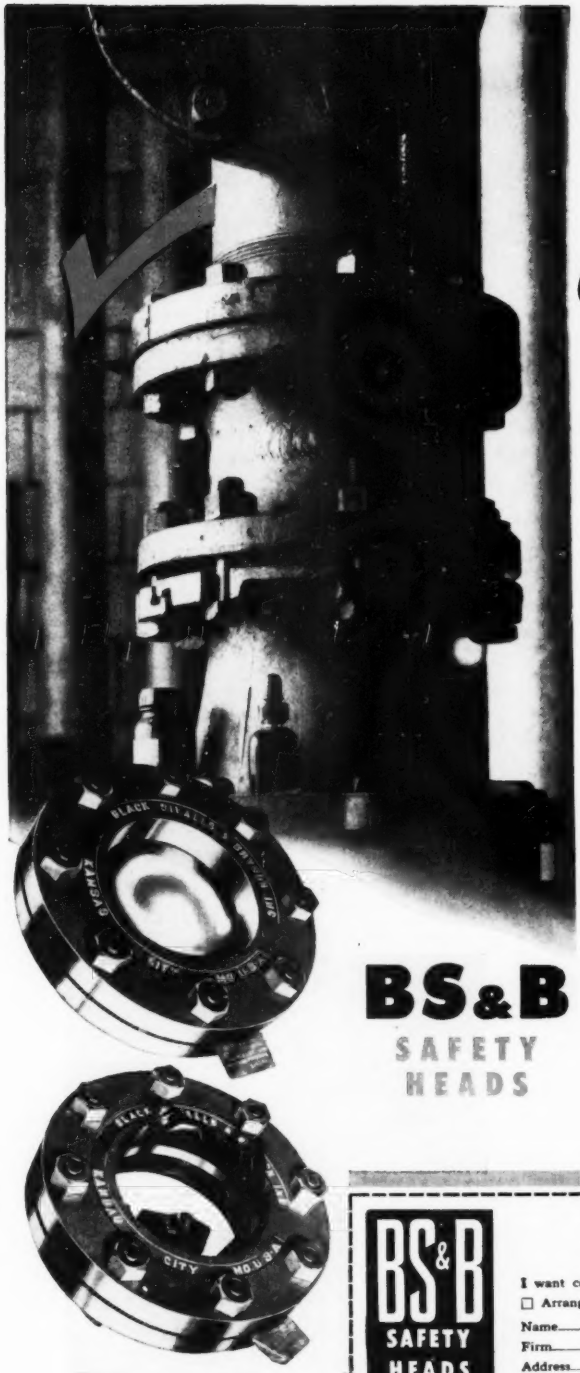
A section lists, pictures, and gives dimensions of all standard refractory brick sizes and shapes. Another deals with properties and behavior of refractories. Engineers will find practical information on construction with refractories and tables that simplify calculation of numbers and types of brick needed. Other useful material includes information on trade practices, shipping and ordering of material, and a glossary of terms used in the industry.

---

**J J Stephens,** president of Strong, Carlisle & Hammond Co, of Cleveland, has announced purchase by that company of the 2-story brick building, property of the former Burke Machine Tool Co in Conneaut, Ohio. Stephens also mentioned that operations of his company's subsidiary, the Strong Steam Specialty Mfg Co, of Corry, Pa., would be moved to the newly acquired property. Strong Steam Specialties now produces steam traps, pressure-reducing valves and strainers. Other items are to be added to present line later, which will necessitate use of all of the 24,000 sq ft of floor space in the newly acquired Conneaut building.

**Power Chemicals Div,** E F Drew & Co, New York City, is again conducting a series of lectures on industrial water treatment and related problems. The lectures and discussions are conducted by Dr R C Ulmer, technical director, Power Chemicals Div. He is assisted by members of his technical staff. The lectures include courses on fundamentals of water chemistry; industrial water problems; plant problems, such as steam and condensate lines, heat-transfer equipment, service water lines, air-conditioning equipment, evaporators; methods and interpretations of water tests. Also included are sound motion pictures and practical demonstrations.

Plant managers, superintendents, engineers, chemists and other operating personnel are invited to attend these courses. They have started in October at Cleveland, Detroit, Chicago and Cincinnati. The courses are also going to be held in the Hotel Essex, Philadelphia, on Nov 2, 9, 16 and 30. Each meeting starts promptly at 8 pm and lasts about two hours. Registration is by application to *E F Drew & Co, 15 E 26th St, New York, N. Y.*, or at the first meeting of the course.



*For*

# Instant Release

## *from the danger of*

# OVERPRESSURE!

Here, in the Black, Sivalls & Bryson SAFETY HEAD, is a "sure-thing" pressure relief device that has *never failed to work* in all its history. It has no moving parts to stick or get out of order. No thoughtless operator can "screw it down" and prevent it from functioning to protect your personnel and property from destruction.

For the BS&B SAFETY HEAD consists of a simple, pre-formed rupture disc . . . held between specially designed base and hold-down flanges . . . which bursts at predetermined pressure. It is 100 per cent protective! *Nothing* can happen to the SAFETY HEAD that can make it fail to function!

Wait no longer to provide this final safety factor for your personnel and property. Contact the Special Products Division, Black, Sivalls & Bryson, Inc., Power and Light Bldg., Kansas City 6, Mo.

**BS&B**
**SAFETY HEADS**

**BS&B**
**SAFETY HEADS**

Director, Special Products Division, Section SH-6,
BLACK, SIVALLS & BRYSON, INC.
Power and Light Building, Kansas City 6, Missouri

I want complete details concerning BS&B Safety Heads.

☐ Arrange to have a Sales Engineer call on me.

Name_____

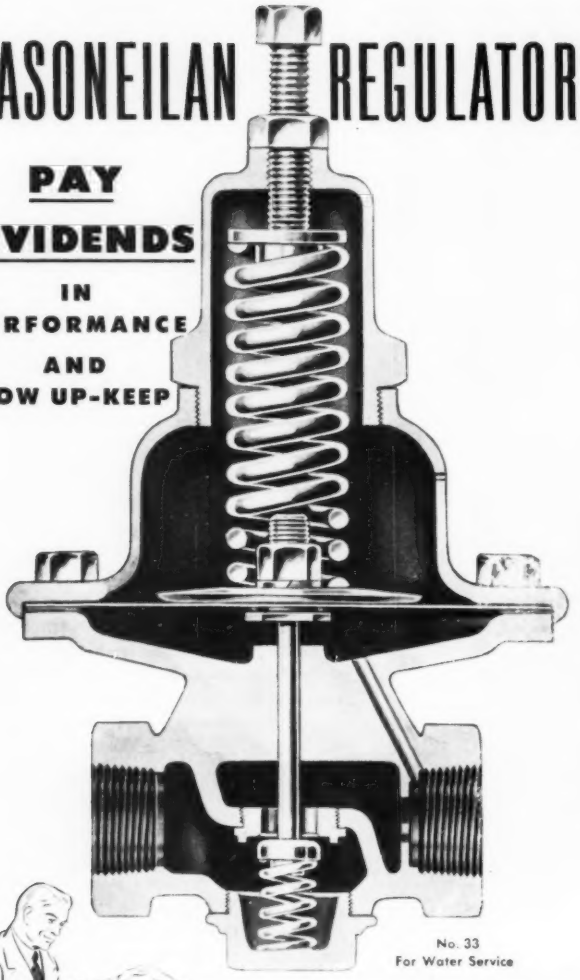
Firm_____

Address_____

City_____ Zone_____ State_____

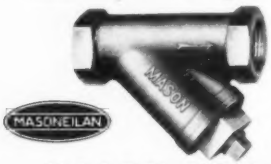
# MASONEILAN REGULATORS

**PAY DIVIDENDS IN PERFORMANCE AND LOW UP-KEEP**



No. 33
For Water Service

The No. 33 Reducing Valve is quality constructed to assure accurate control and tight shut off; is so completely reliable that it rarely needs attention. Use these valves on small steam lines to presses, washers, stills, kettles, sterilizers etc. Available in Sizes ⅛" to ¾"—Bronze body, screwed connections; Body Rating, 200 lbs at 400°F; Reduced pressure ranges 2–20, 20–60; 60–100 psi.




**MASONEILAN STRAINERS**

Prevent scale, dirt, chips, etc. from damaging regulators, traps, valves and pumps . . . use Masoneilan Strainers. These precision-made strainers keep out foreign matter. They eliminate costly maintenance delays.

**MASON-NEILAN REGULATOR CO.**

**1186 ADAMS STREET, BOSTON 24, MASS., U. S. A.**

*Sales Offices or Distributors in the Following Cities:*

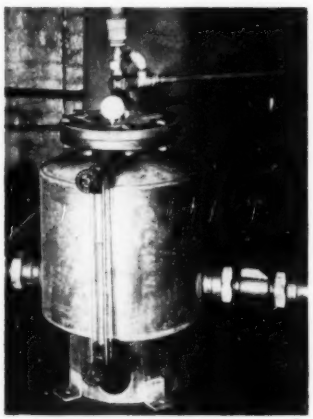
New York • Syracuse • Chicago • St. Louis • Philadelphia • Houston • Denver • Pittsburgh
Cleveland • Cincinnati • Tulsa • Atlanta • Los Angeles • San Francisco • Salt Lake City • El Paso
Boise • Albuquerque Mason-Neilan Regulator Co., Ltd., Montreal and Toronto


## New Equipment

(*Continued from page 144*)

standard 3½-in. round and square cases with 250-deg scales 4.92 in. long for good readability. Designed for general industrial applications, as well as for manufacturers of electronic devices, testing equipments, and similar apparatus, the instruments have permanent-magnet, moving-coil mechanisms.

Housed in molded dustproof and moisture-resisting *Textolite* cases, the instruments are made for flush mounting on nonmagnetic or steel panels. Because of the self-shielding characteristics of the concentric magnet, no special calibration is required for mounting on steel panels. **General Electric Co, Schenectady 5, N.Y.**



**P1112 • CYCLING JET PUMP**—Two-part cycle, which automatically continues until pump is turned off, permits this cycling jet pump to lift by suction and discharge against heads about equal to the gas, air or steam pressure used.

Pump consists of a receiver tank, float-controlled operating valve, ejector and necessary piping, gages and valves. Other than the float-controlled operating valve and two check valves, there are no moving parts. Used to empty sumps, pits, trenches, excavations and for similar applications it also raises water from streams or containers to fill elevated tanks, or boilers, and inject chemicals into vessels or fluid lines. **Penberthy Injector Co, 1242 Holden Ave, Detroit 2, Mich.**

**P1168 • DIESEL ENGINE**—Redesign of Hamilton Series 21-*SA* engine, a 2-cycle 21½x27½-in. unit, yields 38% more hp per cylinder for stationary service. It is now rated at 520 hp per cylinder for 60-cycle 277-rpm generating sets. This is net full-load rating, after allowing for blower power. Redesigned engine can be arranged for dual-fuel operation.

Principal changes include: (1) rotary valves in exhaust outlets, which close while

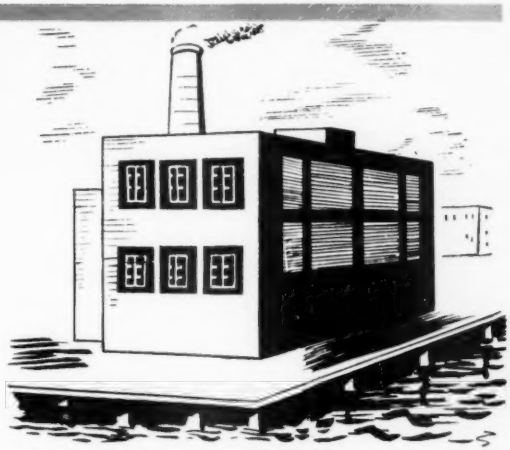
# design for economy with . . .
# OHIO COALS

• Resourceful power plant operators select equipment which permits reliable utilization of coal at the lowest energy cost to obtain definite fuel economy. Ohio Coals assure low steam generating costs, owing to favorable freight rate and mine price.

The installation of versatile burning equipment in accordance with a competitive fuel investigation assures low cost steam generation. Coals entering a given market on short freight rates are better fuel values.

• In many cases small plant steam generating costs are too high, chiefly because coal purchases are limited to a narrow range of costly, long freight rate, premium coals. Ohio Coals are ideally suited for low cost steam generation owing to low freight rates and mine prices.

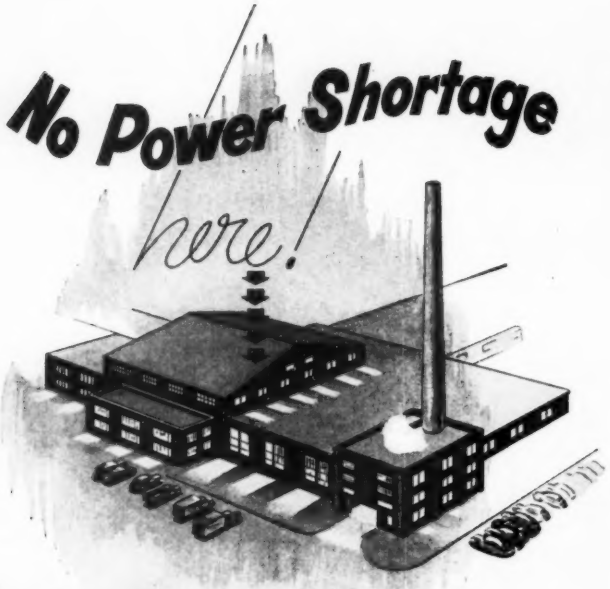
Modern burning equipment design has advanced to the point where complete fuel flexibility is entirely possible—thus enabling operators to purchase the best fuel value under all market conditions.



*The Engineering-Research Division of the Ohio Coal Association will be glad to provide helpful information to power plant designers, operators, and owners on how-to conduct a fuel investigation for lower power costs. WRITE TODAY.*

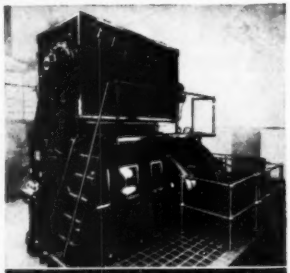
**OHIO COAL ASSOCIATION**

**ROCKEFELLER BUILDING • CLEVELAND 13, OHIO**




**Electric power is generated with . . .**

**SKINNER**
**"Universal Unaflow"**
**Steam Engines**


600 KW. Multi-Cylinder Vertical "Universal Unaflow" Steam Engine

Thousands of power users in a variety of industries and institutions have all the power they need throughout the year, despite seasonal shortages.

They generate their *own power* with Skinner "Universal Unaflow" Steam Engines . . . utilizing exhaust steam for heating, processing techniques or other uses . . . and have found that it is more economical than purchasing power or generating with other prime movers.

Skinner Engines are noted throughout the world for their simplicity and dependability. Maintained economy is guaranteed. The patented poppet inlet and auxiliary exhaust valves remain steam-tight after long use and under fluctuating steam pressures and temperatures.

Small and large concerns alike can "beat the power shortage" with Skinner "Universal Unaflow" Steam Engines. Horizontal sizes 75 to 800 hp. (50 to 500 kw.) and multi-cylinder vertical type 300 to 2250 hp. (200 to 1500 kw.).

*Our engineers will make accurate estimates to prove you can produce dependable power at a fraction of the cost of purchased power. Write for detailed information of the advantages of Skinner "Universal Unaflow" Engines in your industry.*

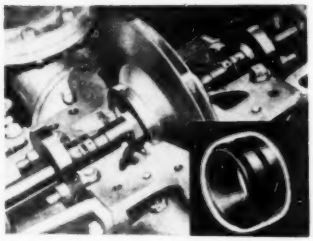
*For Over 80 Years, Doing One Thing Well — Building Steam Engines*

**SKINNER ENGINE COMPANY, ERIE, PA.**


intake ports are closing, trapping about 10% larger air volume (2) larger combustion chamber of improved shape for better scavenging (3) automatic throttling of blower intake at partial loads. These changes give greater output without increase in compression or firing pressures and practically no increase in temperature. Bmep is held to a conservative 74.5 psi.
**Lima-Hamilton Corp, Hamilton, Ohio.**

**P1119 • SPREADER STOKER** — Cheapest sizes of coal or wood chips and sawdust may be burned on the Fyr-Feeder spreader stoker.

A worm feeds fuel from an overhead hopper to a point where it comes in contact with a stream of low-pressure air. The air lifts fuel out over grate with the fines burning in suspension and heavier pieces falling to grate.
**Fyr-Feeder Engineers Div, American Coal Burner Co, 18 East Erie St, Chicago 11, Ill.**



**P1120 • SELF-LUBRICATING SEAL** —Carbon seal is capable of withstanding chemical corrosion, works with highly volatile fluids under high pressures.

Entirely self-lubricating seals are said to be mechanically strong, free from warping and gumming. Self-lapping and polishing, the seal imparts a corrosionproof coating to participating parts.
**Morganite Inc, 3302 48th Ave, Long Island City, N.Y.**

**P1151 • AIR CIRCUIT BREAKER**— Suitable for replacing obsolete oil circuit breakers of insufficient interrupting capacity, *Ruptair* breaker is equipped with individual wheels that aid withdrawal for replacement or for inspection.

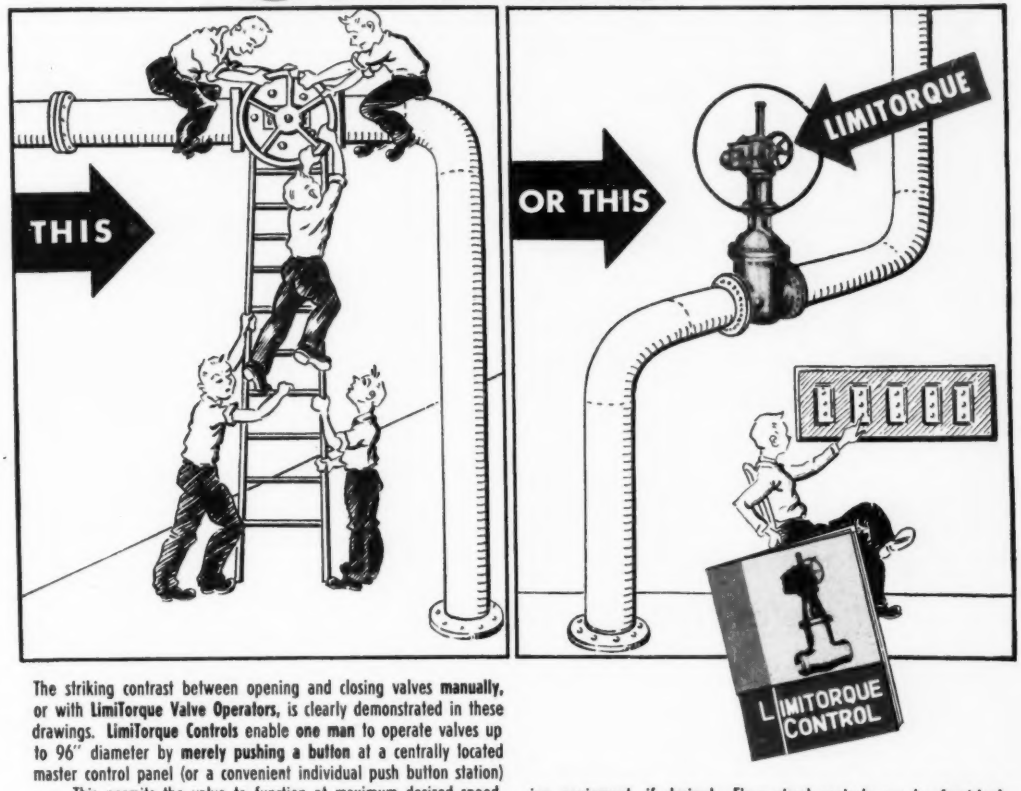
Units offered have interrupting capacities of 100, 150 and 250 mva at 4160 v and 100 and 150 mva at 2300 v. Current-carrying capacities are 600, 1200 and 2000 amp.
**Allis-Chalmers Mfg Co, 951 S 70th St, Milwaukee, Wis.**

**P1165 • OSCILLOSCOPE**—Dual-channel unit makes possible observing and analyzing two independent and rapid phenomena occurring simultaneously. This allows accurate comparison of such variables as speed and vibration, input and output signals of amplifiers, velocity and acceleration.

New *H-21* dual channel oscilloscope contains two separate and complete electron guns in a single, 5-in. flat-face tube. Each channel has individual controls for in-

*Which method of valve operation is safe, sure..*

# ...and SAVES *time... trouble... money...*




The striking contrast between opening and closing valves **manually,** or with **LimiTorque Valve Operators,** is clearly demonstrated in these drawings. **LimiTorque Controls** enable **one man** to operate valves up to 96" diameter by **merely pushing a button** at a centrally located master control panel (or a convenient individual push button station) . . . This permits the valve to function at maximum desired speed, while eliminating all physical efforts and hazards to the workmen.

Remote operation of valves from one central point, with a full knowledge of their **status at all times,** is possible with **LimiTorque.** There are several types of **LimiTorque Controls** applicable for operating all types and sizes of valves, and which can be adapted to existing equipment, if desired. Floor stand controls can be furnished where it is not practical to fit the controls directly to the valve yokes.

Thousands of **LimiTorques** are used in water and sewerage works, central stations, private power plants, oil pipelines and refineries, on ships, etc. Send for our 96-page catalog, and please use your Business Letterhead when writing for same.

## Philadelphia Gear Works, INC.

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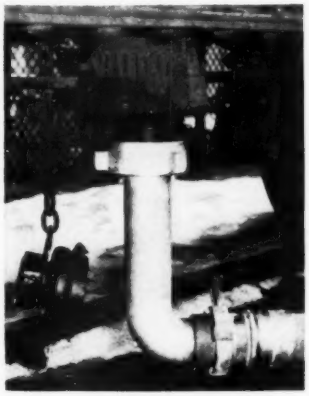
**NEW YORK • PITTSBURGH • CHICAGO • HOUSTON**
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

*Industrial Gears and Speed Reducers*
*LimiTorque Valve Controls*

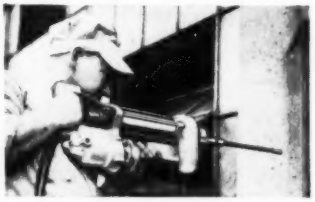
Prescription for industrial temperatures
150
200
WESTON
100
250
50 °F 300
Rx
EADABLE
ELIABLE
UGGED
WESTON
All-Metal Thermometers
Rugged, all-metal construction . . . stainless steel stems . . . bold, readable dials . . . accuracy within 1% over the entire scale—all add up to the answer to industry's toughest temperature measurement requirements. Choose a dependable WESTON thermometer from a variety of types, stem lengths and scale ranges. Call your jobber, your WESTON representative, or write for Thermometer Bulletin . . . WESTON Electrical Instrument Corporation, 660 Frelinghuysen Avenue, Newark 5, New Jersey.
CONTACT MAKING models for alarm or control purposes.
MAX-MIN models to indicate highest or lowest temperature reached.
WESTON Instruments


tensity, focus, and X, Y and Z axes. Unit weighs 65 lb, and is 14¼ x 16¾ x 21 in. in size.
**Electronic Tube Corp, 1200 East Mermaid Lane, Chestnut Hill, Philadelphia 18, Pa.**



**P1106 • TANK-CAR FITTING**—An unloading fitting weighs less than 10 lb for universal tank-car use and may be hooked up in less than one min. One man can easily lift the fitting in place and tighten the collar by hand, which eliminates need for heavy pipe wrenches.

Made from cast aluminum, the fitting has a high tensile strength to withstand hard usage and is suitable for unloading most of tank car. Fitting is available in 10- and 15½-in. lengths, with a 3- or a 4-in. outlet pipe thread. Standard reduction fittings may be added.
**Mead Cornell & Co, P O Box 2682, Cleveland 7, Ohio.**



**P1144 • ELECTRIC HAMMER**—Model 25-*RO* rotating electric hammer has an automatic safety clutch, and drills up to 2-in. diameter holes. The percussive hammering can be stopped while the bit continues to rotate to clean the hole. Device weighs 38½ lb and is available for either 110- or 220-v ac operation.
**Syntron Co, 492 Lexington Ave, Homer City, Pa.**

**P1152 • FLUORESCENT LAMP TESTER** — Compact device for testing fluorescent tubes, tube starters and incandescent lamps. May be used for portable or permanent mounting.

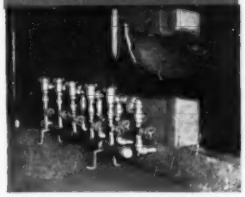
Case is made from 20-gage steel with baked white enamel finish with protecting rubber bumpers. Device is equipped with

# WHAT ARE YOU PAYING *for Condensate?* $ $ $ $

If your steam heated equipment is not supplied with hot, dry steam kept in intimate contact with the heated surface and free from air, you are paying for fuel that is being thrown away every hour.

Worse yet, you are paying double in lost production and rejects, if your equipment is not properly trapped and vented.

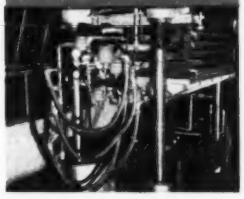
AUTOS



## $ LOST TIME

Heating up time was reduced from 3 hours to 1 by using Sarco No. 9 Thermostatic Traps on enamel ovens in a large auto body plant. This trap has large air venting capacity. Removes condensate at 10°F below steam temperature.

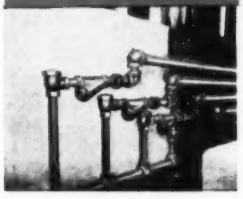
PLASTICS



## $ REJECTED GOODS

With seven platens on this large plastics press, the weakest link (one cold section) made rejects frequent and without notice. Now seven Sarco Bucket Traps kick out the condensate and provide trouble-free production. This trap is ideal for releasing condensate as quickly as it forms—a must on plastics presses.

GREENHOUSE

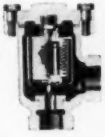


## $ LOST FUEL

Most manufacturers don't know how much fuel they are losing due to inefficient trapping. In greenhouses, where fuel is a large part of the cost, monthly fuel bills tell the story fast. This greenhouse saved 30% of the fuel and 60% of the make up water by using Sarco Thermostatic traps on every line and every coil.

## FOUR TYPES OF SARCO STEAM TRAPS TO CHOOSE FROM

Sarco makes all accepted types and can fit the trap to the job. Ask for trap selection chart No. 1600.



THERMOSTATIC

FLOAT-THERMOSTATIC

BUCKET

LIQUID EXPANSION

251

**SARCO SAVES STEAM**

**SARCO COMPANY, INC.**

*Represented in Principal Cities*

**Empire State Building, New York 1, N. Y.**

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

# ALLPAX the PACKING that never sticks...

ALLPAX is the packing that does the packing job *right*. You can use it advantageously on hot or cold liquids or gases and be assured of a leak-tight, scoring-free service which will save you time and money in maintenance. Because of its field of application, ALLPAX is a *universal* packing.

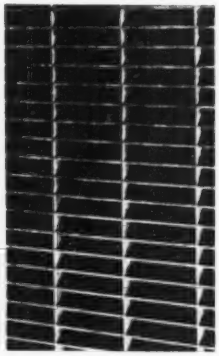
ALLPAX never sticks because it is compounded in such a way as to prevent it. Thin flakes of anti-friction metal and tiny scales of graphite are imbedded all through long, tough fibres of asbestos. To this is added a special non-liquid, heat-proof lubricant. Shafts and rods rotate or slide smoothly without scoring or sticking.

ALLPAX is available in various diameters for a wide range of stuffing box sizes and is easily cut to exact length required and slipped into place without waste. Available also in loose form for general service.

*A trial of ALLPAX will quickly convince you that ALLPAX is the packing for your packing jobs. Your nearest distributor can supply you.*

**THE ALLPAX COMPANY, INC.**
*Mamaroneck, N. Y.*

# HENDRICK ALUMINUM GRATING



**SAVES WEIGHT — RESISTS CORROSION**

**Because it combines light weight, with ample strength, and high corrosion-resistance, Hendrick Mitco Aluminum Grating is especially desirable for many purposes.**

**It is being successfully used in such widely different applications as shipboard installations and in sewage disposal plants.**

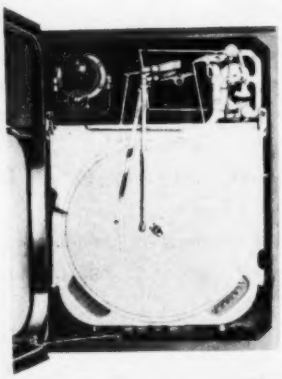
**Its light weight minimizes handling and erection costs, and maintenance painting is not required. Write for full information on this recent Hendrick development.**

SEE OUR CATALOG IN SWEET'S

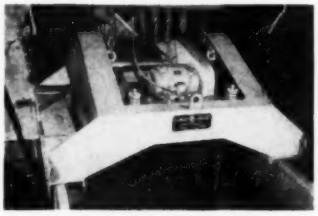
**HENDRICK**
*Manufacturing Company*
**46 DUNDAFF STREET, CARBONDALE, PENNA.**
*Sales Offices In Principal Cities*

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids


momentary circuit-breaking control switch and operates from any 120-v 60-cycle outlet.
**Gould Electric Supply Co, 2015 Jerome Ave, Bronx 53, N.Y.**



**P1136 • PNEUMATIC CONTROLLERS**—Series 500 controllers automatically control temperature, pressure, flow, liquid level, humidity and pH. Instruments have on-off, proportional, reset, derivative, and reset plus derivative action.
**Bristol Co, Waterbury, Conn.**



**P1170 • CAR SHAKER** — A sturdy compact, self-contained vibrator unit is designed for rapid, economical unloading of bulk granular materials from open-top, hopper-bottom gondola cars to conventional track hoppers serving bulk materials-conveying equipment. It is recommended for unloading coal at boiler houses and retail yards, unloading sand, coke, ore, gravel and cinders and for accelerating removal of damp materials frozen in cold weather.

Cars need not be uncoupled while shaker is in operation. This permits movement of cars through the unloading zone as a complete train. Cars are moved into place over conventional track hoppers in the usual manner with the aid of car hauls, spotters, switch engines or other means. After the car gates have been opened, the car shaker, which is normally suspended from a hoist, is lowered to top of the car to begin its operation. Rotation of the shaker's vibrator shaft at normal speed causes the vibrator end of the shaker to rise and fall, and impart heavy hammerlike blows to the car, equal in number to speed of the vibrator shaft. Energy of these impacts on the

# cut operating costs with OIC PACE-SETTER IN VALVES

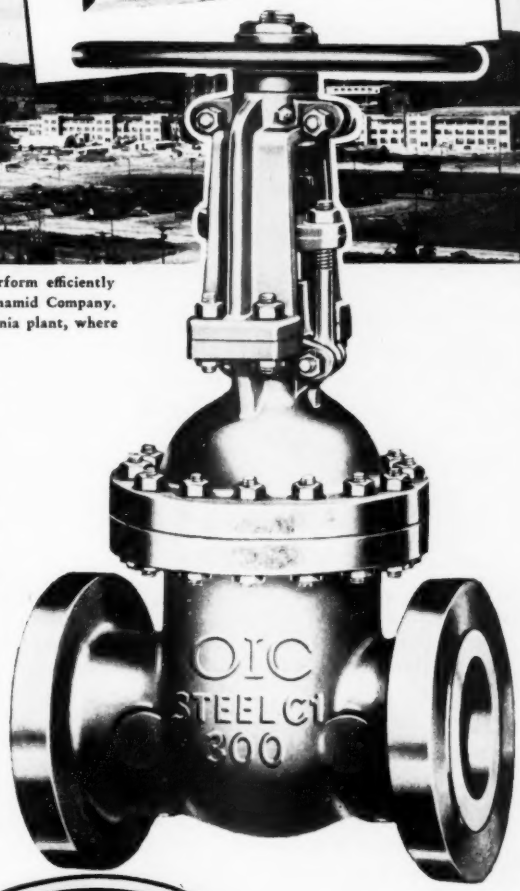
AMERICAN CYANAMID COMPANY. OIC Valves perform efficiently for the Calco Chemical Division of the American Cyanamid Company. Shown here is the company's Willow Island, West Virginia plant, where OIC Valves are installed.

Hundreds of companies, in industry after industry, are entrusting their important flow control job to the OIC long line of pace-setting valves.

The reasons are simple — these companies are finding that OIC Valves cut operating costs and give more efficient service — and they're *safer!*

In OIC Valves, leak-proof joints guard against sudden pressure-drop. The flow is protected from turbulence. Heavier-than-required construction in all parts keeps pressures and stresses within safe bounds. Wedges of heavy I-beam design stop all flow with positive closure, or open the ports for smooth, *free* flow. Integral body ribs guide the wedge to its seats with unerring accuracy — effectively reduce vibration and wear.

Handle *your* flow control requirements with OIC Valves! Their many pace-setting features cut your operating costs to a new low!




ELIMINATE VALVE CHANGE-OVER PROBLEMS WITH THE HANDY OIC CROSS REFERENCE CHART

Valve replacement made easy! Simply check the number of the valve on the line, look in the chart, and you'll find the right OIC Valve to replace it. Write for your *free* copy to The Ohio Injector Company, Wadsworth, Ohio.

0-548-18

OIC VALVES

FORGED STEEL • CAST STEEL • IRON • BRONZE

77-1-1

MODERN boiler design assures good planning — quality fabrication and erection, good construction.

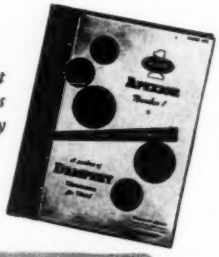
But it's surface maintenance that determines whether boiler tubes will carry the heavy traffic of high pressures, temperatures and ratings at through-way — or just back-road — efficiency.

That maintenance starts, for the new boiler, before it goes into service. Over a base of clean, bare metal, APEXIOR NUMBER 1 lays a surface that takes the wear and takes it better than does any boiler steel.

Insoluble in all boiler waters, APEXIOR frees metal from threat of corrosive attack from causes known and unknown — smooths it so that deposits adhere less readily and can be removed more easily, at less cost.

That's why every tube of the APEXIORized boiler is a high-speed highway that steps up circulation and evaporation — keeps heat-transfer efficiency high and heat distribution uniform — assures maximum availability.

*This new bulletin gives all the facts about APEXIOR Protective Surfacing for tubes and drums, in boilers new or old. A copy is yours for the asking.*



**DAMPNEY** Maintenance for Metal

THE DAMPNEY COMPANY of AMERICA • Hyde Park, Boston 36, Mass.

vertical car sides is transmitted directly to sloping portions of hopper-car bottom for loosening and unloading material.

With aid of a Link-Belt car shaker and proper spotting facilities, about eight to ten cars per hr may be unloaded. Shaker weighs 9500 lb with a 20-hp, 3-phase, 60-cycle, 220- or 440-v motor.

**Link-Belt Co, 300 W Pershing Rd, Chicago 9, Ill.**

**P1132 • LIQUID COOLER**—Packaged cooler in 5- to 100-ton sizes contains a complete refrigeration cycle. Unit is fully shop assembled.

The package has a heavy-duty Freon compressor, motor and starter, necessary controls to maintain operation, a shell-and-tube liquid cooler and refrigerant condenser.

**Doyle & Roth Mfg Co, Foot of 23rd St, Brooklyn 32, N.Y.**

**P1137 • FLAME ARRESTER**—Safety device combines the patented *VVH* pressure-vacuum vent with a flame arrester that prevents propagation of flame into storage tanks containing volatile and costly liquids.

Rubber-to-metal sealing makes the valve tight and prevents it freezing shut. Unit has been tested and approved by Underwriters' Laboratories.

**Black, Sivalls & Bryson Inc, 720 Delaware, Kansas City 6, Mo.**

**P1131 • WELDING ROD**—Deoxidized copper sheets and plates can be welded with Anaconda Copper 372 rod using the inert-gas-shielded arc method.

Consistently satisfactory welds in fabricating pressure vessels of deoxidized copper result with the 372 rod of 98% copper con-

# Hot...but never bothered... thanks to TIMKEN® bearings

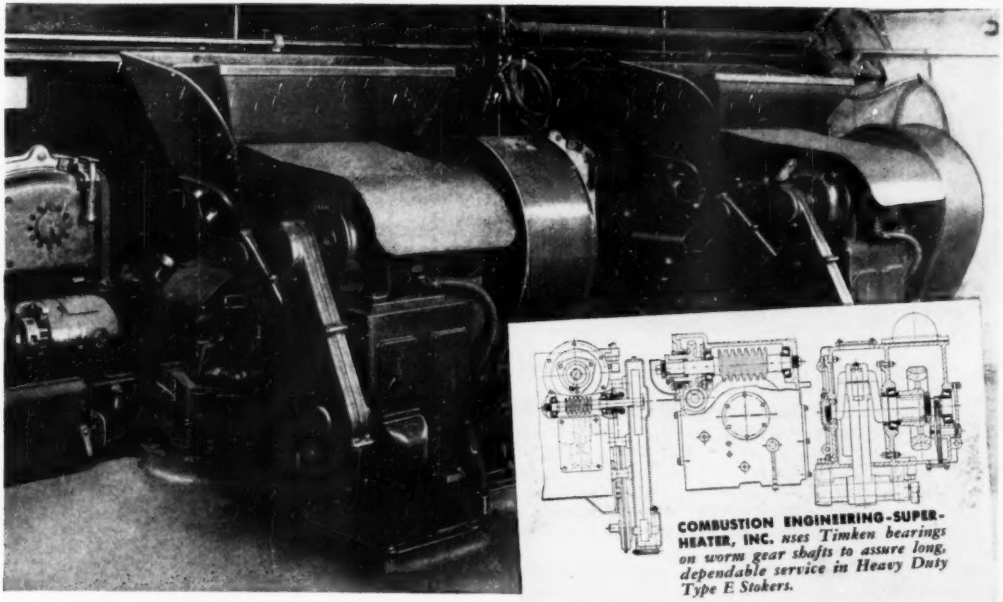
A STOKER'S job is hot and tough—but this Heavy Duty Type E Stoker made by Combustion Engineering-Superheater, Inc., takes it in stride. Timken® bearings on the worm and crankshafts help to assure years of trouble-free operation with a minimum of maintenance.

Timken tapered roller bearings hold shafts in positive alignment. End-play is kept under constant control. Gears mesh smoothly and wear on moving parts is reduced. Due to their tapered construction, Timken bearings carry both radial and thrust loads in any combination. Line contact between the rolls and races provides extra load-carrying capacity. And because Timken bearings are manufactured to extreme limits of precision, friction is reduced to a minimum.

Rolls and races of Timken bearings are made from Timken fine alloy steel for toughness and case-hardened to give them maximum resistance to wear. Normally they last the life of the machine in which they are used.

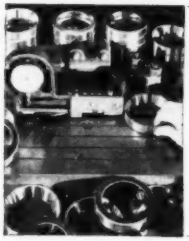
Dependable performance in countless applications have made Timken bearings and Timken bearing equipped products first choice throughout industry. Whether your job is building or buying machinery, always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

*This symbol on a product means its bearings are the best.*





**COMBUSTION ENGINEERING-SUPERHEATER, INC.** *uses Timken bearings on worm gear shafts to assure long, dependable service in Heavy Duty Type E Stokers.*



**WITHIN ONE HALF A THOUSANDTH OF AN INCH!**

. . . that's an example of the accuracy demanded in the outside diameter of Timken bearing cups in order to pass inspection.

The Timken Company is the acknowledged leader in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis Timken steels.

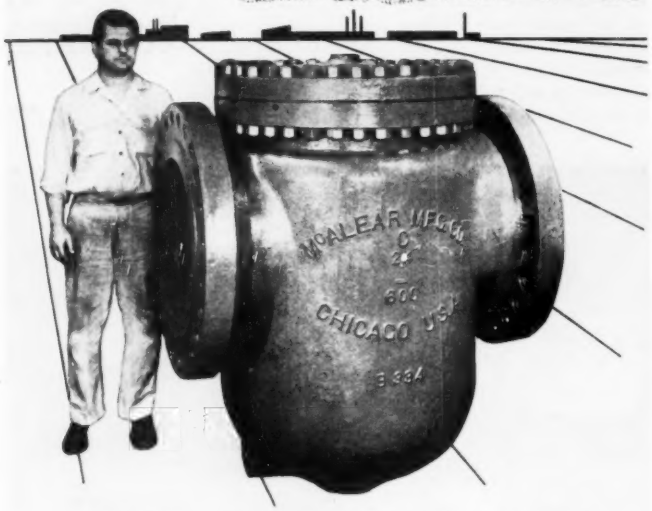
**TIMKEN**

***TAPERED ROLLER BEARINGS***

TIMKEN 1899 50 1949 YEARS

**NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ◫ LOADS OR ANY COMBINATION**

# McALEAR
## STRAINERS

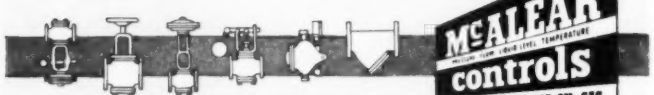



**ANY SIZE ANY PURPOSE ANY MATERIAL**

If your piping plan calls for strainers, consider the McAlear line. It ranges in size from ½″ to 24″ and includes all types . . . flanged or screwed bodies . . . clamped or bolted covers . . . bodies and baskets of steel or virtually any special alloys . . . pressure ratings for all services. The strainer above, for example, is one of several shipped for hydraulic service. Body, cast steel. Basket, stainless steel. Size, 24″. Weight, 10,000 pounds.

Write today for Bulletin No. 128 describing the standard McAlear line. Or tell us your requirements for *any* type of strainer.

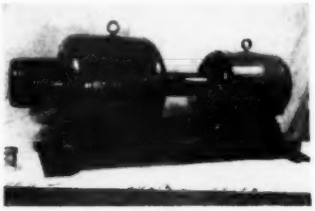
**McALEAR Mfg. Co.**
1909 SOUTH WESTERN AVENUE
**CHICAGO 8,** ILLINOIS




REPRESENTATIVES IN PRINCIPAL CITIES

*AN INDEPENDENT MANUFACTURER FOR OVER 40 YEARS*


tent. Weld metal is sound, ductile, with full strength of annealed base metal that requires no peening or working the welds to develop maximum strength.
**American Brass Co, 25 Broadway, New York 4, N.Y.**

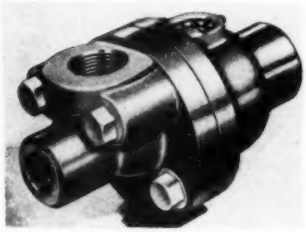


**P1164 • MG SET**—*Katolight* sets are available for changing dc to ac, ac to dc or from one frequency to another. Variable-pitch pulleys are available to permit adjusting speed with motor and generator running.

Sets are available in sizes up to 300 kw, 15 to 400 cycles. Special radio filtering is available for many sizes, keeping radio interference to five microvolts either conducted or radiated on frequencies ranging from 150 kilocycles to 150 megacycles.
**Kato Engrg Co, Mankato, Minn.**

**P1110 • FLEXIBLE COUPLING** — Lightweight, flexible, shaft-coupling, revolving casing is made of aluminum alloy and split axially to permit installation or removal in a space no longer than the coupling.

It is made in two types to fit over hubs of a 2-strand roller chain coupling. Seals at both ends of the coupling make the casing lubrication tight to protect against abrasive and corrosive atmospheres.
**Diamond Chain Co, Indianapolis 7, Ind.**

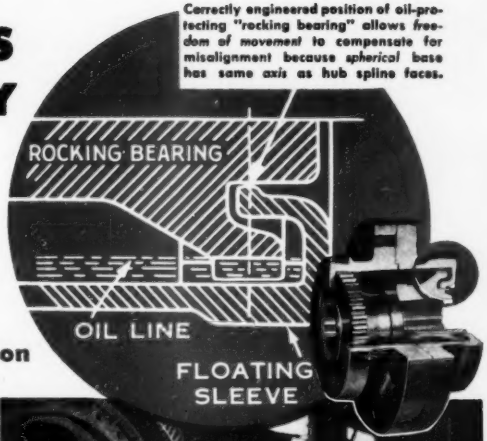


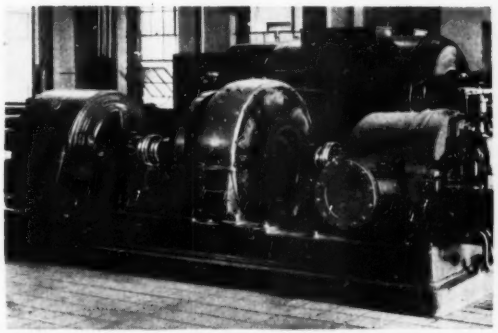
**P1105 • ROTATING JOINT**—Joint operates at 150 psi and at speeds of 150 to 300 rpm. Handles hot water, hot oil and other fluids for heating or cooling equipment that rotates. Sealing surfaces have hard chrome plating for long wear, and have cadmium plating inside to resist rust and corrosion. It is available in 1-, 1½-, and 2-in. sizes.
**Chiksan Co, Brea, Calif.**

**P1141 • AIR AND STEAM FILTERS** —Type *RA* purifier removes oil, water, pipe scale, etc, from compressed air and steam lines. It may be used on steam

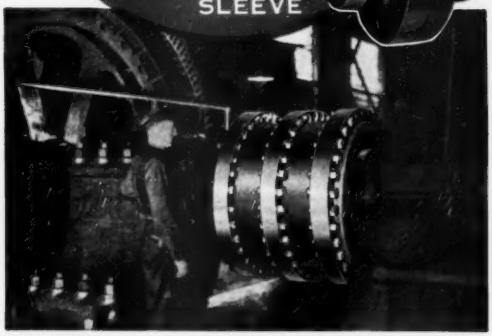
# FAST'S COUPLINGS STOP UNNECESSARY SHUTDOWNS IN *Your* PLANT

**Exclusive Metal-to-Metal Seal And No Perishable Parts Give Uninterrupted Power Transmission**


Correctly engineered position of oil-protecting "rocking bearing" allows freedom of movement to compensate for misalignment because spherical base has same axis as hub spline faces.
ROCKING BEARING
OIL LINE
FLOATING SLEEVE



***POWER PLANTS*** use Fast's Couplings because metal-to-metal seal, absence of perishable parts, virtually eliminate shutdowns!



***STEEL MILLS*** specify Fast's Couplings for equipment of every shaft size to avoid production shutdowns caused by *failure* of ordinary couplings! This Coupling has been in use since 1923!

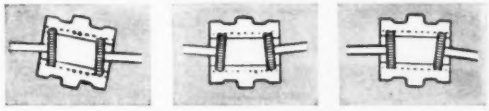
FAST'S Couplings virtually eliminate plant shutdowns because Fast's exclusive metal-to-metal seal gives positive protection, provides uninterrupted power transmission! Complete flexibility to compensate for shaft misalignment is done mechanically. Load-carrying oil is *completely* guarded by exclusive "rocking bearing" that keeps out dirt, grit and moisture without perishable packing rings! Nothing to wear! Nothing to replace! Result: Uninterrupted power transmission for all your installations!

Fast's complete line of Couplings is available right from stock from distribution points coast-to-coast. All Fast's Couplings are backed by years of top engineering experience, Koppers' high standard of workmanship, and unexcelled coupling service including available parts if required by change of drive, *even if your Fast's have been running for 30 years!* Fast's installed on your equipment mean longer machine and motor life, lower upkeep costs, minimum shutdown losses. Write today or use the handy coupon and get all the facts in the new Fast's Catalog. Address: KOPPERS CO., INC., FAST'S COUPLING DEPT., 341 Scott Street, Baltimore 3, Maryland.

### Compensate for all Misalignment

The floating sleeve takes a neutral position. All forms of misalignment are compensated for between the lubricated faces of the splines, equally divided between driving and driven members. The entire assembly revolves as one unit.

***The exaggerated diagrams below demonstrate this Fast's principle***



# FAST'S *Self-Aligning* COUPLINGS

KOPPERS

**MAIL FREE CATALOG COUPON TODAY!**

**KOPPERS CO., INC., Fast's Coupling Dept., 341 Scott Street, Baltimore 3, Md.**

Please send me your Fast's Coupling catalog No. 47 which contains all the facts and specifications.

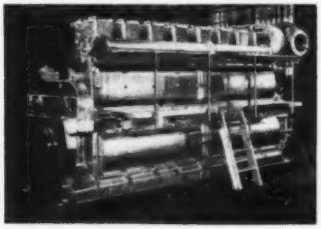
Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

# The ALCO PLAN for DIESEL ECONOMY



## Flexibility and Low Cost Offered by ALCO Standardized Engine

THE ALCO plan helps Diesel plants where flexibility, economy, dependability, and provision for future growth are important. In one size of stationary Diesel engine, ALCO offers unusual advantages where multiples of 540 to 1,300 horsepower can be used.

**LOW COST**...This basic design, also used in ALCO switch engines, is quantity-produced to make both first cost and the cost of replacement parts unusually low.

**FLEXIBILITY**...You can fit fluctuating load curves more closely than with fewer engines of larger size, or of varied capacity.

**LESS WEAR**...This more efficient use of engines means less wear per installed horsepower. The unused capacity of operating engines at any time need not exceed the capacity of one engine. There is no wear on the idle engines. Larger engines would necessitate greater wear per installed horsepower, with resulting higher costs.

**GREATER EFFICIENCY**...With engines operating near rated load, fuel consumption is less and operating conditions are better.

**UNIFORM ENGINE WEAR**...With several units of the same size, engines can be operated in rotation, allowing planned inspection and maintenance with minimum "down time."

**STAND-BY ECONOMY**...When all units are the same size, stand-by capacity can be limited to one size of engine the same as all others. With a variety of engine sizes, stand-by capacity might easily have to equal the largest single unit.

**SIMPLIFIED MAINTENANCE**...Uniform engine size means uniformity of replacement parts and of maintenance procedures; smaller stocks of parts; minimum of special tools; shorter "down time."

**EASY GROWTH**...As demand increases, gradual growth can take place by adding extra units of the same size.

**ALCO**
**STANDARDIZED**
**DIESEL ENGINES**

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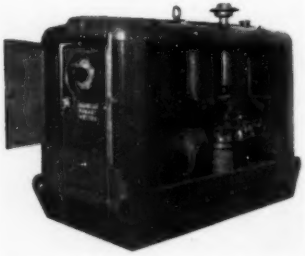
**AMERICAN LOCOMOTIVE COMPANY**
**Dept. D-6, 30 Church Street, New York 7, N. Y.**

Please send me your illustrated brochure on ALCO *Standardized* Diesel Engines.

Name
Company
Address
City Zone State


lines up to 400 psi and 650 F and for compressed air or gas not exceeding 800 psi and 100 F non-shock service.

Purifier features a helicoid tuyere constructed of monel or stainless steel. Centrifugal principle upon which the purifier operates is initiated as the stream enters the unit and engages helicoid tuyere.
**Centrifix Corp, 3029 Prospect Ave, Cleveland 15, Ohio.**

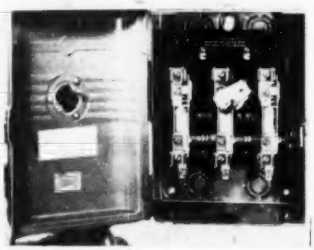


**P1123 • ARC WELDER**—New low-cost line, the *Bantam Champ*, dc arc welder is gasoline-engine driven, rated at 200 amp at 25 v on 50% duty cycle.

Unit is 55 in. long by 22 wide by 38½ high and weighs about 770 lb. Generator is a modified multirange type with four laminated main poles and four interpoles. Dual controls are also modified multirange with five ranges of welding current and 100 steps of va adjustment in each range.
**Hobart Brothers Co, Box 489, Troy, Ohio.**

**P1150 • HIGH-VOLTAGE CONTACTOR**—Type 256 high-voltage contactor is 15 in. wide, 25 in. deep and 38 in. high, and has double break contacts. A vertical direct-action solenoid-type magnet helps eliminate the need for flexible leads, turning shaft and shaft bearings.

Three principles of arc extinction are incorporated in this contactor. These include two breaks in series, magnetic blowout, and increasing length of arc path both horizontally and vertically.
**Allis-Chalmers Mfg Co, Milwaukee, Wis.**



**P1161 • SAFETY SWITCH**—For modern high-capacity industrial distribution systems, the *HCI* switch has an entirely new arc-quenching design and actuating mechanism. Both give it ability to break

## Scale-Free Surface Condensers Save Operating Costs

**DESCALING** surface condensers the truly effective Oakite way is thorough. So thorough, in fact, that all lime scale, rust and similar deposits are completely removed and normal heat transfer efficiency quickly restored. In one Oakite-conscious plant, for example, not only was there a significant improvement in vacuum after Oakite descaling, but operating costs were reportedly cut $360 per month.

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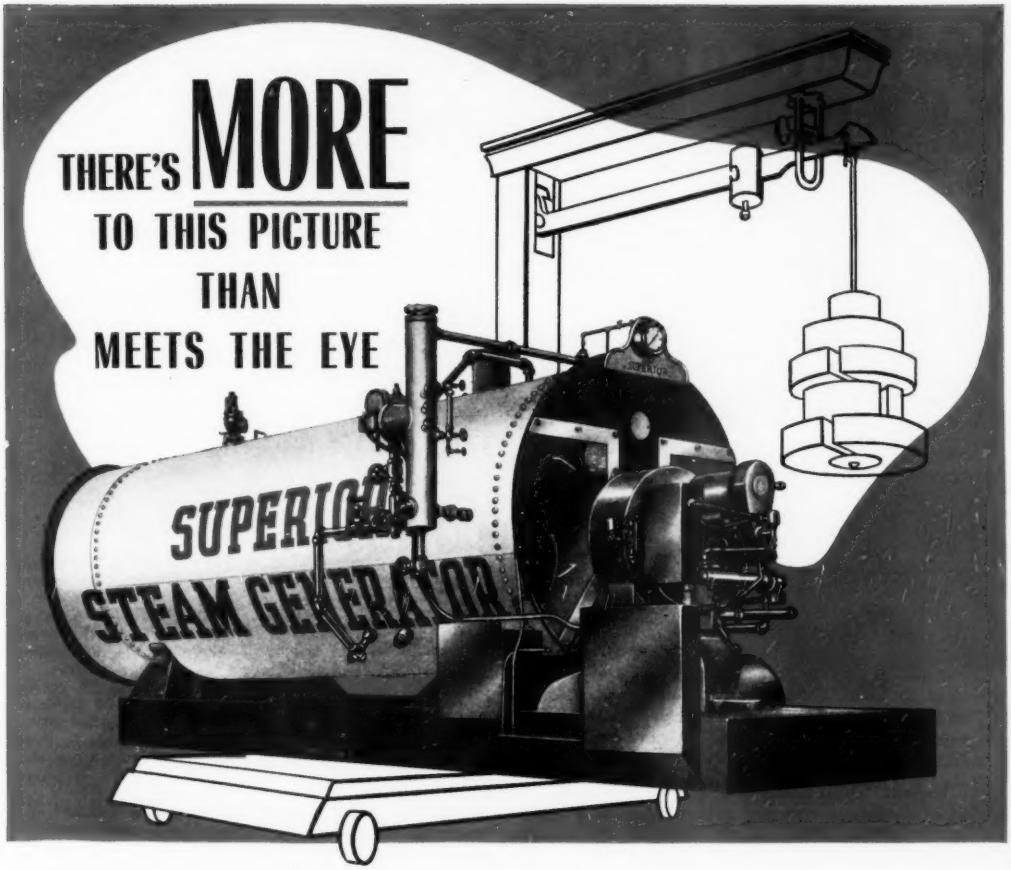



## What's this . . . steam generators by the pound?

But doesn't it make sense that greater heating surface and larger steaming areas go hand-in-hand with increased weight? And doesn't sturdy, rugged, built-for-life construction add even more weight?

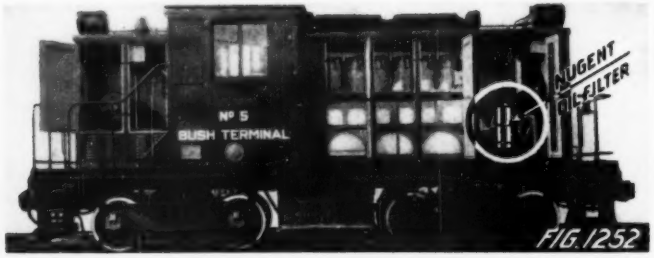
Of course it does . . . and that's a thought which tips the balance with consulting engineers who specify *Superior* Steam Generators. For after weighing all the factors of unit purchase with undivided responsibility, completely automatic operation with any kind of oil or gas, induced draft which eliminates the need of a chimney, simple installation, and guaranteed thermal efficiency in excess of 80% . . . after all this, specifying engineers look for long-lived dependability . . . and find it in Superior's rugged construction, ample steam space and larger heating surfaces . . . the features which make Superior Steam Generators weigh more.

**Superior Steam Generators are available in capacities from 20 to 500 b. h. p. for pressures up to 250 p. s. i. For complete details write for catalog 101.**

**Superior Combustion Industries, inc.**

*Factory* Emmaus, Pa.
*Executive Offices* Times Building, Times Square, New York 18, N. Y.

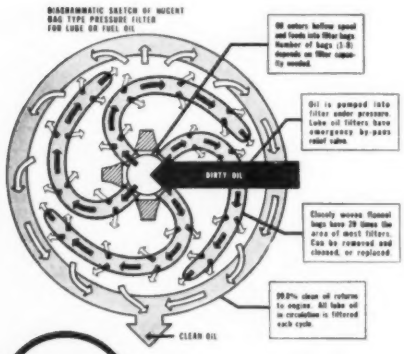
# 19 Years of Protection for 7 Diesel Locomotives




## with NUGENT "Full Flow Filtering" Pressure Filters

In 1930 Bush Terminal Warehouse, Brooklyn, N. Y., put into service seven Ingersoll-Rand diesel powered G.E. locomotives. All were equipped with Nugent "FULL FLOW FILTERING" Bag-Type Filters for lube oil. Now after 19 years all seven locomotives are still in service and only one has had to be overhauled (that after 18 years service). The Nugent Filters are cleaned every three or four months and the bags washed and re-used. Here is proof of the long term economy and effectiveness of Nugent Full Flow Filtering.

Nugent "FULL FLOW FILTERING" Filters are equally effective on compressors, pumps, turbines, gas engines, machinery, etc., and may be used on a wide variety of oils and other fluids. What is your problem?




### What is "Full Flow Filtering"?

"Full flow filtering" is complete filtering of **all** the oil **every** cycle. No unfiltered oil by-passes the filter carrying harmful foreign material to moving parts. In Nugent "FULL FLOW FILTERING" Filters, dirt is collected on the inside of the filter bags which when clogged can be cleaned and re-used or discarded and replaced at your preference. For maximum economy and longest equipment life be sure and specify Nugent "FULL FLOW FILTERING" Filters.

**Wm. W. Nugent & Co., Inc.**
402 N. Hermitage Ave. CHICAGO 22, ILLINOIS

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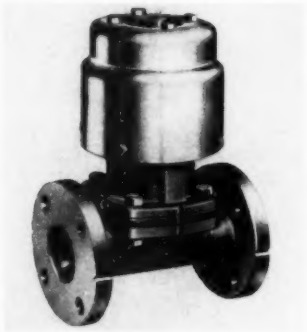
unusually heavy loads quickly and safely.

Unique arc-quenching feature uses magnetic repulsion action. Arcs formed by double-break contacts repel each other and drive against grid pins that cool and deionize them. Units are available in 30-, 60- and 100-amp sizes.

**Trumbull Electric Mfg Co, Plainville, Conn.**



**P1143 • VALVE ACTUATOR**—Lightweight, compact and leakproof actuator for pneumatic or hydraulic operation is available for Grinnell-Saunders diaphragm valves. Actuator uses Bendix-Westinghouse *Rotochamber* principle of a rolling-sleeve seal.

Operating pressures up to 105 psi can be used, but usually only 50 psi is required to close the valve against 100-psi line pressure. It is available in air-to-close, air-to-open, and double-acting combinations. Actuator handles diaphragm valves from ¾- to 6-in. sizes.

**Grinnell Co, Providence I, R.I.**

**P1142 • PIPE GASKET**—Spiral-wound all-metal gasket of ferrous and non-ferrous metals is ideally suited to applications where high temperatures are encountered and the confined materials have high permeability.

**Flexitallic Gasket Co, Camden, N.J.**

**P1117 • PLATE MAGNETS**—Redesign of complete line of Eriez permanent non-electric *Standard* and *Jumbo* plate magnets has resulted in a 50% increase in magnetic strength and a 30% decrease in weight. Lighter weight and compact construction

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## the T21, Miniature Frahm Tachometer

*. . . measures speeds quickly and accurately simply by touch or permanent mounting*

This is the T21 . . . the new, low-cost, *miniature* Frahm Tachometer which offers all the advantages of simplicity, dependability and long life of Frahm Resonant-Reed Instruments. It will measure the speed of a large steam turbine, gyro or centrifuge as simply and easily as that of fractional hp motor-driven equipment. Just touch the casing of the machine or mount the instrument at some convenient location.

The T21 operates on the Frahm Resonant-Reed principle wherein tuned steel reeds respond—by resonance—to the slight vibration of the machine against which the instrument is held or on which it is mounted. That is all there is to it. The instrument has no parts to wear out, needs no maintenance, imposes no load on the machine under test, nor can it be damaged by overspeeding. And, the T21 is available in 11 various ranges to suit your needs. Whether for shop or tool kit use, you'll want this low-cost, precision-made, yet rugged tachometer for your speed measuring problems.

**THE T21 MEASURES SPEED**

SIMPLY BY TOUCH . . . . . . OR BY MOUNTING ON MACHINE

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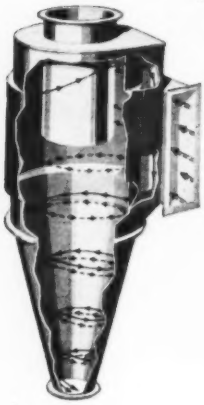
is vital in COLLECTING



Butterfly net promises

to catch everything are unrealistic in trapping fines, ultra-fine and finer-than-that in fly-ash particles. But Buell adjusts its equipment *and your costs* to do a maximum job where results are tangible. No guesswork, no overall assumptions; but a special laboratory analysis of your dust into fractions of different micron-size grading—and a guaranteed performance on each fraction . . . Scientifically arrived-at assurance of potential results is a fundamental part of Buell's engineering service. It is freely available, with no obligation whatsoever. Bring us your problems . . . or, as a preliminary, let us send you 'Engineered Efficiency in Dust Collection'. Write: Buell Engineering Company, 70 Pine Street, Suite 5045, New York 5, New York.

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Manufacturing in the United States and Canada for shipment throughout North and South America.


enable these magnets to be installed in a minimum amount of space and make installation simple.

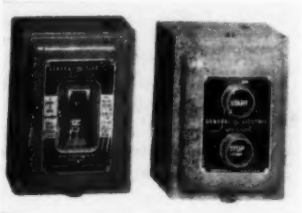
These magnets are available for installation in metal or wooden chutes, feed tables, hoppers, etc, with or without hinges. Sizes range from 4 to 72 in. wide, in increments of 2 in.

**Eriez Mfg Co, 1177 East 12th St, Erie, Pa.**

**P1128 • CEMENTED CARBIDE**—Higher hardness, more wear resistance, greater cutting-edge strength are claimed for an improved No. 905 grade of Carboloy cemented carbide.

The No. 905 cemented carbide is used for finishing and light-roughing cuts on non-ferrous metals and cast irons with hardness up to brinell 550. Tools tipped with this material show a long service life, give good performance on long cuts and high production jobs.

**Carboloy Co, Detroit 32, Mich.**



**P1160 • AC MOTOR STARTER**—Line of manually operated starters are for ac motors up to 7½ hp. Starters are specially designed for use on textile looms, small pumps, blowers and grinders. Units are furnished in both toggle and pushbutton types in 2-, 3-, and 4-pole forms.

Starters feature bimetallic overload protection, replacing the solder-pot relay. In addition, starters are equipped with a wide range of heaters, all closely following motor heating curve.

**General Electric Co, Schenectady 5, N.Y.**

**P1148 • DRY LUBRICANT**—Smooth-textured molybdenum compound powder is suitable for extreme bearing-pressure applications. *Molykote*, Type *Z*, has high chemical and thermal stability and inertness.

It resists attack of all but a few acids and its lubricating characteristics are not affected by temperature from sub-zero to 750 F. It may be applied dry in powder form or mixed with solvents, oils or greases. It is finding increasing service as a wear-in lubricant for dies, gears and machinery.

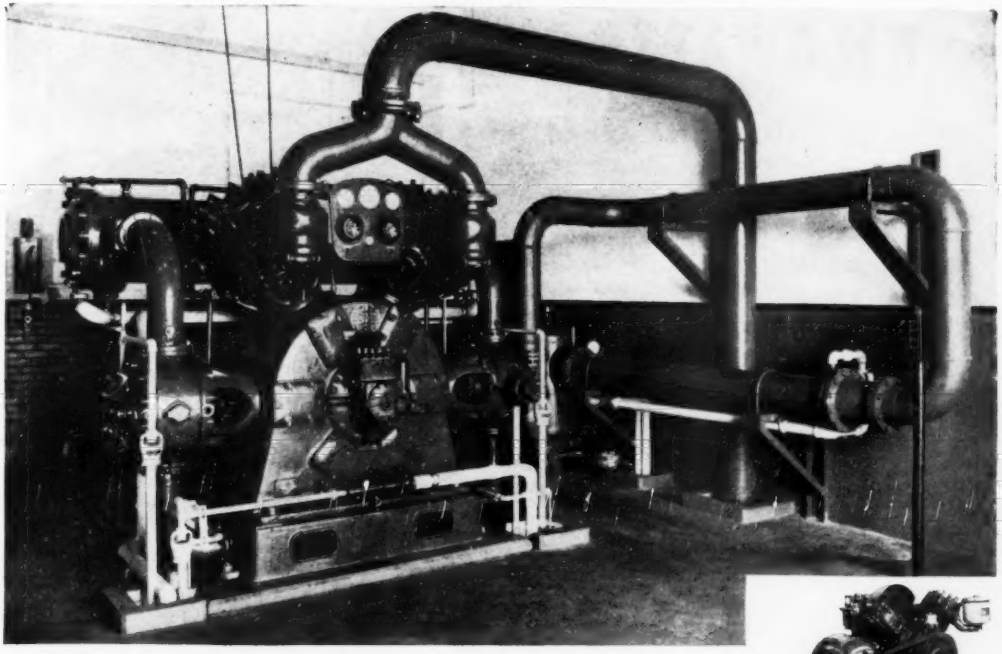
**Alpha Corp, Greenwich, Conn.**

**P1121 • PROTECTIVE COATING**—Self-priming vinyl base paint, *Tygon Series K*, adheres tightly to wood, metal or concrete.

Coating may be brushed on or sprayed. It shows excellent resistance to corrosive fumes of all acids and alkalies, as well as

## High Air Capacity . . . Unmatched in

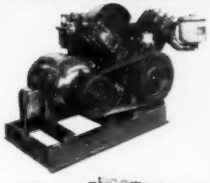
# LOW AIR COST



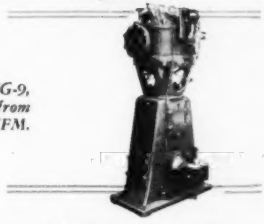
# JOY WN-114 COMPRESSOR

The JOY WN-114 is a four-cylinder, two-stage, double-acting compressor producing 1092 to 3656 CFM in single units, and up to 7312 CFM in twin units, depending on pressure. Exclusive "Dual-Cushion" valves provide top efficiency in low-cost air power. ● JOY builds the most modern compressors available for either centralized or decentralized air supply—*write for Bulletins.*

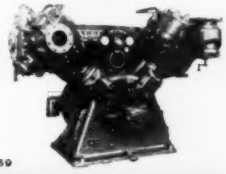
*Consult a Joy Engineer*



*The JOY WL-80, in 9 sizes from 81 to 590 CFM.*



*The JOY WG-9, in 11 sizes from 153 to 822 CFM.*



*The JOY WN-112, in sizes from 378 to 1828 CFM.*

W&D 12059

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GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

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# 3500 EXTRA KILOWATTS

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*APPLICATION TO EXISTING PLANT ENGINEERED BY . . .*

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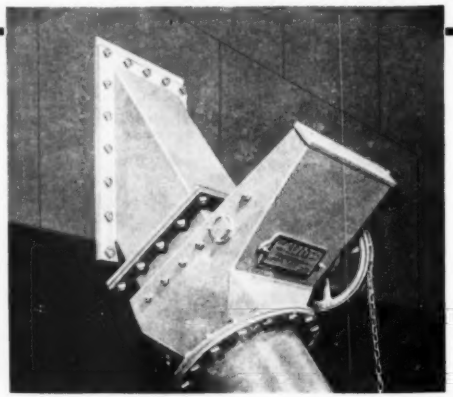


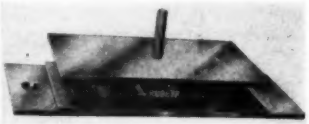
**S-E-CO. COAL VALVES** can be made for installation in an inclined position, as shown in photograph. In some plants if coal valves are installed in this position, a considerable saving in headroom results. These valves are equipped with a disc brake so that they are not self-closing.

*Your inquiry would be appreciated.*

**STOCK ENGINEERING COMPANY**

715P Hanna Building ★ Cleveland 15, Ohio


to excessive humidity, grease, oil and alcohols. Aromatic hydrocarbons, ketones and esters soften it. Non-oxidizing and non-flammable when dry, *Series K* possesses an upper temperature limit of 200 F.
**U. S. Stoneware Co, Akron, Ohio.**



**P1163 • VIBRATION MOUNT**—Designed for use with generators, pumps and compressors, where horizontal and rotary machinery vibrations are present, vibration isolation and attendant noise reduction are accomplished through the "rubber-in-shear" principle.

Device consists of a specially designed steel channel floated in rubber between two steel angles. While over-all height is only 2 in., it has a load range from 600 to 10,000 lb.
**Finn & Co, 2850 Eighth Ave, New York 30, N.Y.**

**P1125 • MODULAR COOLER**—Stainless steel, aluminum or electrolytically zinc-coated steel facing adhesively bonded to plywood modules, called *Amorply* panels, enables assembly of walk-in coolers of any size at the plant location where refrigeration is desired.

Such a cooler has the advantages of: (1) light weight, efficient use of floor space (2) simplicity of design and assembly or disassembly (3) an impervious barrier to transfer of water vapor (4) 4 in. thickness of insulation in panel cavity. Standard modular panels are available for coolers 8 ft high; 8, 10 or 12 ft wide and, within 2-ft multiples, any length desired.
**United States Plywood Corp, Weldwood Bldg, 55 W 44th St, New York 18, N.Y.**

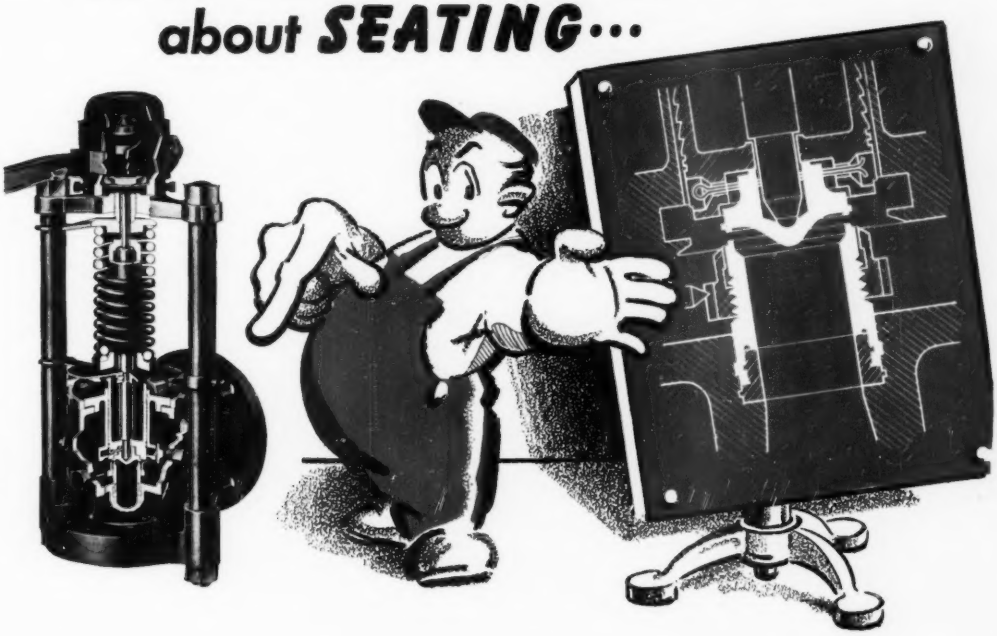
**P1162 • PLATING RECTIFIER**—Selenium units form the core of this electroplating rectifier. Dc continuous output is 2000 amp at 6 v or 1000 amp at 12 v.

Each rectifier has a step-down transformer, rectifier, stack, cooling fan and magnetic contactor. Weighing 1000 lb, each unit is 63 in. high, 32 in. wide and 20 in. deep.
**Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio.**

(*Continued on page* 196)

# We Studied SAFETY VALVE LEAKAGE

## — Here's what we found out about SEATING...



**We found** — what most power plant men already know...that in order to be tight, a safety valve must have matched, wear resistant, corrosion resistant seating surfaces, and that the disc must seat square.

**We found** — what power plant men have long suspected...that uneven expansion, causing dragging of one seating surface over the other, can destroy the seat so completely that the safety valve has to be overhauled or replaced, even though it has never been popped.

**We found** ...that when nozzle and disc are made of alloys with the same coefficient of expansion, and with sections designed so that their rate of heat absorption is the same, destructive drag is eliminated. This is one of the basic features of the Gentzel Design, and is the reason Foster 38-SV Safety Valves can be guaranteed to stay tight.

**To you** ...this means elimination of costly boiler outage due to safety valve leakage. Other guaranteed *and proven* advantages are...consistently accurate popping ...minimum blow-down, which can be held to as little as 1%...highest relief capacity for a given nominal valve size...and extremely low maintenance.

For full details on the design and construction features that enable this valve to outperform ANY other safety valve, get in touch with your Foster Representative or with us direct.

# FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS... PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

**835 LEHIGH AVENUE • UNION, N. J.**

*The New*

# ROTOJET

*Gives you the*

# POWER

*to clean tubes*

# FASTER

You won't believe any tube cleaner can pack such tremendous power, until you try the new ROTOJET. It removes scale so much faster that it usually pays for itself in one cleaning. Models available for practically any size straight and curved tubes. Send for ROTOJET Bulletin.



**THE SECRET**

ROTOJET Motor has only two moving parts, a shaft and a paddle. Positive contact between paddle and Rotocentric (egg-shape) bore cylinder prevents stalling at low speeds. No leakage. Delivers maximum power for air used.

*S-530 ROTOJET Air-driven Motor with swing-frame head for 3¼–3-13/16" I.D straight tubes.*

**ELLIOTT COMPANY-ROTO DIVISION**

**153 Sussex Avenue** **Newark 1, N. J.**


## Another Contract for McNary Dam Construction

McNary Dam contractors, a combination of the Guy F Atkinson Co, Ostrander Construction Co and J A Jones Construction Co, has been given notice to proceed with construction work on the Oregon shore at McNary Dam on the Columbia River under terms of a $15,835,539 contract.

The contract calls for construction of a "junior" cofferdam to enclose an area for a portion of the power-house excavation, the concrete substructure for two main power units, station service unit and assembly bay for the power house, a portion of the Oregon shore abutment and a "second-step" cofferdam that will provide for the final power house and spillway work.

Completion is specified by May 1, 1951, the Corps of Engineers stated.

---

**A contract for construction** of $1,000,000 steam power plant at Cassville, Wis., has been awarded to F H McGraw & Co, engineers and constructers of New York, Hartford and Chicago, by the Dairyland Power Co-operative of LaCrosse, Wis. Located on the east bank of the Mississippi River, the new 18,000-kw plant will furnish power for farms in the southwest section of Wisconsin and northeast section of Iowa. According to Donald W Neville, McGraw vice-president, in charge of the project, ground-preparation work has already started.

**Air Reduction,** manufacturers of industrial gases and welding equipment, introduced a new shape-cutting machine, the *Airco No. 3 Monograph*, at its exhibit in the National Metal Exposition on Oct 17-21, at Cleveland, Ohio. In addition, the company announced that the Aircomatic process has been extended to include welding of stainless steels. This process, introduced at last year's metal show, had been limited to aluminum. There were continuous demonstrations of both the Monograph and Aircomatic processess.

**Dravo Corp** has been awarded the contract as construction agent for Elrama power plant of Duquesne Light Co, Pittsburgh, to be built at Elrama, Pa., four miles above Clairton on the Monongahela River. Initially, the plant will contain two 95,000-kw steam-turbine generators, largest to be specified for the Duquesne Light system, and will add 190,000 kw to the system's present 802,000-kw capacity, an increase of more than 23%. Currently being designed by Duquesne Light's engineering staff, the plant is scheduled to be under construction by Dravo early next year. The completion date will be about mid-year 1952.

Elrama's proximity to Upper Monongahela Valley coal, including that from Duquesne Light's own Warwick coal mine at Greensboro, which can be brought to the station by river, rail or truck, influenced selection of the site. Plans for the power station include electrostatic dust precipitators on the two boilers. Each boiler has a capacity of 900,000 lb per hr at 1250 psig and 950 F.

# PLANT EQUIPMENT NEWS

## Reader Service Page for New Products and Literature

*Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.*

### AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATING

**A7** **AIR HANDLING EQUIPMENT**—American Blower Corp, Detroit 32, Mich. 47-page booklet No. 2-478 shows a comprehensive and complete line of equipment manufactured by American Blower for practically every known air handling requirement.

**A8** **LOW-PRESSURE REFRIGERATING UNITS**—Frick Co, Waynesboro, Pa. Bulletin No. 791-A contains specifications on Frick Eclipse low-pressure refrigerating units with compressors of 2, 3, 4 or 6 cylinders, 4¾-in. bore by 4¼-in. stroke.

**A9** **PACKAGED AIR CONDITIONERS**—Air Conditioning Dept, General Electric Co, Bloomfield, N. J. Series of catalogs No. PMT9-2401, PMT9-2402, PMT9-2403 and PMT9-2401, present packaged air conditioners for a wide variety of applications. Specifications, ratings and dimensions are given for each unit.

**A10** **TUNNEL FREEZER**—Frick Co, Waynesboro, Pa. 4-page folder features Frick tunnel freezer with both conveyor and pass trucks for handling foods. Several types are illustrated.

### BOILERS AND AUXILIARIES

**B15** **FEEDWATER REGULATION SYSTEMS**—Swartwout Co, 18611 Euclid Ave, Cleveland 12, Ohio. 16-page catalog No. S-27 describes new impulse feedwater regulation systems and related equipment. Illustrations are included.

**B16** **REFRACTORIES**—Walsh Refractories Corp, Dept M, 101 Ferry St, St. Louis 7, Mo. Bulletin features Multitex, super-duty fire brick and Multitex K8, special super-duty refractory. Properties, typical applications and many other refractory materials are listed in a convenient reference table.

**B17** **SUSPENDED ARCHES**—Laclede-Christy Co, Ambassador Bldg, St. Louis 1, Mo. 12-page booklet presents informative data on Laclede suspended arches and sectionally supported walls including their application to all types of furnace enclosures.

**B18** **ROTARY POSITIVE BLOWERS**—Roots-Connersville Blower Corp, 900 W Mount St, Connersville, Ind. 8-page folder No. 81-B-47 covers smaller size Type AF rotary positive blowers for pressure or suction service. A capacity and pressure range table of each blower size is given together with a dimension chart of all standard sizes.

### CONTROLS, ELECTRIC

**D8** **MOTOR STARTER** — Allis-Chalmers Mfg Co, 861 S 70th St, Milwaukee, Wis. Leaflet No. 1487114 discusses features and operation of Allis-Chalmers Type RMC manually operated reduced-voltage auto-transformer motor starter.

**D9** **VARIABLE SPEED CONTROL** — Reeves Pulley Co, Columbus, Ind. 4-page bulletin No. VN-4913 tells about improved design of Reeves Vari-Speed Jr unit for light hp machinery. Photographs, price list, rating and dimension tables are included.

**D10** **RADIATION PYROMETER**—Bristol Co, Waterbury 91, Conn. 12-page booklet No. P1942 explains theory of radiation pyrometry and features of the Pyrovisor radiation unit. Diagrams



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illustrate accessories offered to adapt the unit for use with furnaces and kilns for indicating, recording and controlling temperatures up to 1694 F.

**D11** SWITCHBOARDS—Taller & Cooper, Inc, 75 Front St, Brooklyn 1, N. Y. 11-page catalog No. PL-100 covers special power-control equipment. Pictured are switchboards, panel boards, gage boards, and control consoles.

**D12** MERCURY SWITCHES — Brown Instruments Div, Minneapolis-Honeywell Regulator Co, Wayne & Roberts Aves, Philadelphia 44, Pa. 24-page bulletin No. 1143 describes a number of types of Honeywell mercury switches used for electrical switching. Engineering data and selection tables are presented, as well as switch specification charts.

**D13** INDUSTRIAL AND GENERAL-PURPOSE RELAYS—Ward Leonard Electric Co, Electronic Distributor Div, 33 W Jackson Blvd, Chicago 4, Ill. Catalog No. D-30A covers various types of relays, gives contact ratings, coil specifications, sizes, current list prices, and other helpful data on ac and dc units.

## CONTROLS, MECHANICAL

**E7** AUTOMATIC CONTROLS AND INSTRUMENTS—Partex Corp, 500 W Oklahoma Ave, Milwaukee 1, Wis. 4-page leaflet No. 5099 shows a typical example of the application of a system of automatic controls and instruments for over-fire draft control of commercial stoker-fired installations.

**E8** AIR-OPERATED CONTROLLERS —Bristol Co, Waterbury 91, Conn. 32-page book No. A130 discusses the firm's new line of Series 500 air-operated controllers for automatically controlling temperature, pressure, flow, liquid-level, humidity and pH value.

**E9** AUTOMATIC COMBUSTION CONTROLS—Ace Instrument Co Inc, 173 Pacific St, Brooklyn 1, N. Y. 16-page bulletin No. C-32 presents features and illustrations of Ace automatic combustion controls.

**E10** COMBUSTION SAFEGUARD — Bristol Co, Waterbury 91, Conn. Brochure No. W1114 tells about Bristol's new combustion safeguard, electronic Pyrotrol. Applications are outlined.

## ELECTRICAL EQUIPMENT

**F18** LARGE DC MOTORS — Allis-Chalmers Mfg Co, 983 S 70th St, Milwaukee, Wis. 40-page book No. 6M6403A covers latest construction features of Allis-Chalmers' large dc motors.

**F19** MOTORS, GENERATORS, CONTROLS—Ideal Electric & Mfg Co, Mansfield, Ohio. Series of 4 catalog-insert bulletins shows varied types of electric motors, generators and controls produced by Ideal.

**F20** ELECTRICAL LINE — General Switch Corp, 44 Rostling St, Brooklyn 31, N. Y. 24-page bulletin gives details on complete line of enclosed safety switches, service-entrance equipment, branch-circuit or residence panels, panelboards for light and power distribution, and wireways and fittings.

**F21** ELECTRICAL INSULATION — Minnesota Mining & Mfg Co, 900 Fauquier St, St. Paul 6, Minn. 4-page folder describes Scotch-Weld, a new electrical insulating plastic film for coils that is applied like tape and then heat-treated.

**F22** PLUGS, RECEPTACLES, CORD CONNECTORS—Russell & Stoll Co Inc, 124 Barclay St, New York 7, N. Y. 12-page booklet No. RS-48-375 features automatic-locking Midget Ever-Lok plugs, receptacles, and cord connectors.

**F23** RECTIFIERS—Raytheon Mfg Co, Waltham 54, Mass. 4-page brochure contains illustrations, diagrams and schematics of the new Raytheon Rectifilter, a battery eliminator. A complete list of models, with full specifications is included.

**F24** SELENIUM RECTIFIERS—Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa. Booklet No. DB-B-828 tells the story of Westinghouse standard and high-voltage selenium rectifiers for power supplies and electronic circuits. Tabular presentation of schematic diagrams, formulas for calculating rectifier performance, and coil ratings for a wide range of applications are given.

**F25** ELECTRICAL SPECIALTIES — Cutler-Hammer Inc, 236 N 12th St, Milwaukee 1, Wis. 1949-1950 edition of Cutler-Hammer merchandising catalog. Illustrated and described is the company's line of safety switches, service control and multi-breakers, motor control and electrical specialties.

## INSULATION, HEAT, COLD AND VIBRATION

**H3** VIBRATION ISOLATORS—Finn & Co, 1550 Eighth Ave, New York 19, N. Y. 24-page reference book furnishes information on the company's complete line of vibration isolators. Also included is a comprehensive discussion of the theory of vibration isolation and shock.

**H4** ASBESTOS VARNISHED-CAMBRIC INSULATION — Rockbestos Products Corp, New Haven 4, Conn. Booklet, entitled "The Story of An Insulation," explains constructional features of Rockbestos AVC insulation, showing how and why the conductor can be operated at 110 C.

**H5** SPRAYED-ON INSULATION — Insul-Mastic Corp of America, Oliver Bldg, Pittsburgh 22, Pa. 24-page bulletin No. G161 features Insul-Mastic Type D, a spray-applied insulation for low temperature work with ability to waterproof, rustproof, deaden sound, prevent condensation and resist fire.

## MAINTENANCE AND SAFETY EQUIPMENT

**K5** TUBE EXPANDERS — Thomas C Wilson Inc, 21-11 44th Ave, Long Island City 1, N. Y. 8-page brochure No. 310 describes Wilson-Dudgeon line of tube expanders for high-pressure boiler tubes, superheaters, economizers, waterwalls, circulating tubes, downcomers and risers in stationary and marine steam generators.

**K6** PLASTIC BRUSH-COATING—A C Horn Co Inc, 10th St & 44th Ave, Long Island City 1, N. Y. 4-page folder discusses Tread-Sure, an abrasive-filled plastic brush-coating that produces an antiskid surface on wood, concrete, or steel deck flooring.

(Continued on page 186)

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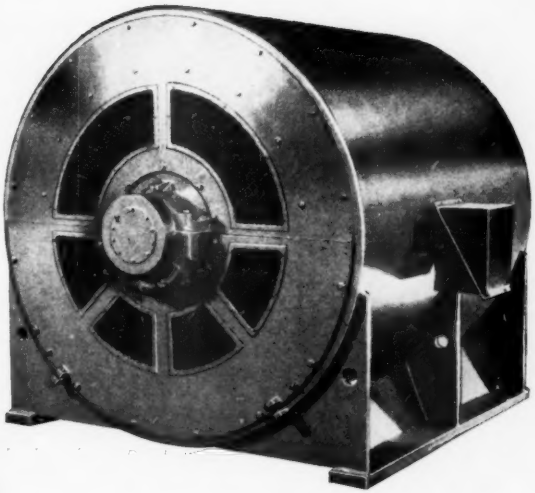
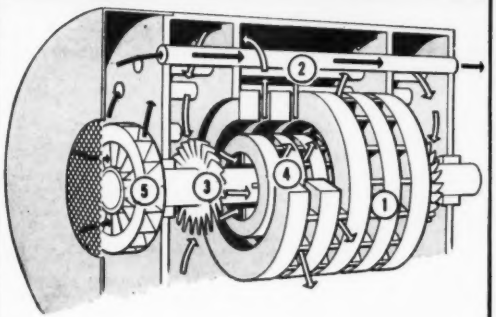
# TUBE-TYPE
## TOTALLY-ENCLOSED FAN-COOLED MOTORS!



# INSTALL INDOORS or OUT!

## How Tube Cooling Works




Stator core (1) is surrounded by tubes (2). Internal fans (3) circulate air through ducts (4) in rotor and stator and around tubes, transferring heat to tubes.

External fan (5) drives outside air through tubes, removing heat and keeping tubes clean. All electrical parts are enclosed. Dirt cannot enter.

- **Dirt-proof and corrosion-resistant**
- **Heat exchanger is practically *self-cleaning***
- **Simple self-contained cooling system—sizes from 75 to several thousand horsepower**

WHEREVER DUST, DIRT, fly ash, rain and snow, smoke, or corroding fumes keep motor maintenance costs high, this Allis-Chalmers tube-type motor will cut maintenance sharply.

All electrical parts—including stator core—are enclosed. Simple heat transfer system keeps temperatures well within rated limits. Cleaning is rarely needed because air passages are unrestricted. Air flow through the straight tubes removes foreign matter.

Important savings have been proved in three years of field operation. Sizes from 75 hp and up. Also explosion-proof designs. For complete information, outline your requirements to your A-C Sales Office, or write for Bulletins 05B7150 and 51R7149.

A-2610

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## BIGGEST STEAM TRAP NEWS in 50 years!

## INCREASES TRAP DRAINAGE CAPACITY OVER 100%!

**Duo-Step Leverage—can save thousands of dollars annually for steam trap users . . . in lower initial cost and greater drainage efficiency.**

DUO-STEP LEVERAGE NOW AVAILABLE IN THESE CLARK STEAM TRAPS
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Send for the story on Clark DUO-STEP Leverage today!

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Reducing Valves
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Float Traps
Open and Inverted Bucket Steam Traps


**K7** **PIPE HALF SOLES**—Black, Sivalls & Bryson Inc, 720 Delaware, Kansas City 6, Mo. 4-page booklet No. 193 shows cut-away views of standard and crimped type pipe half sole. Table of specifications and prices is included.

### MAINTENANCE MATERIALS

**L21** **INDUSTRIAL VACUUM CLEANERS**—Breuer Electric Mfg Co, 5100 Ravenswood Ave, Chicago 40, Ill. 4-page leaflet tells about Breuer Tornado industrial vacuum cleaners. Illustrations of application are given.

**L22** **ANTI-CORROSIVE PAINTS**—Subox Inc, Fairmount Plant, Hackensack, N. J. 6-page bulletin contains technical properties, varieties and uses of Subox and Subalox, anti-corrosive paints.

### MATERIALS HANDLING

**M12** **ELEVATOR CONTROL** — Otis Elevator Co, 260 Eleventh Ave, New York 1, N. Y. 8-page booklet No. B-2056-9450 describes operation of an individual supervisor's control unit for Autotronic elevatoring.

**M13** **SCREEN CLOTH**—Robins Conveyors Div, Hewitt-Robins Inc, 270 Passaic Ave, Passaic, N. J. 16-page catalog No. 113-A gives informative data on Robins woven-wire screen cloth. Tables enable the reader to determine at a glance the sizes of openings available for a given diameter of wire.

**M14** **SWITCHING LOCOMOTIVE** — General Electric Co, Apparatus Dept, Schenectady 5, N. Y. 16-page bulletin No. GEA-3810A describes 80-ton diesel-electric locomotive for industrial switching. Fully illustrated, the bulletin points out salient features of the unit.

**M15** **BELT CONVEYORS** — Lippman Engrg Works, 4603 W Mitchell St, Milwaukee 14, Wis. 32-page book No. 1400 gives complete information on stationary, portable and 16 types of special-purpose belt conveyors, both troughed and flat belt.

**M16** **MOBILE POWER UNIT**—Sinex Projects Inc, 40 Wall St, New York 5, N. Y. 4-page folder No. 100-MU presents the Sinex 100-kw mobile power unit. Specifications, design features and applications are given.

**M17** **RESEARCH AND MANUFACTURING** — Caterpillar Tractor Co, Peoria 8, Ill. 16-page booklet No. 12394 highlights research and manufacturing processes behind Caterpillar diesel track-type and wheel-type tractors, engines, and earthmoving equipment.

### MECHANICAL TRANSMISSION

**N11** **BALL AND ROLLER BEARINGS** —Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill. 112-page data book No. 2550 covers the company's complete line of ball and roller bearings. Construction features, list prices, weights, load ratings and all necessary dimensions for various standard models available are included.

**N12** **MULTIPLE V-BELT DRIVE** — Fort Worth Steel & Machy Co, 3600 McCart St, Fort Worth, Texas. 40-page catalog No. 50 is replete with selection and application tables of multiple V-belt drive. Complete engineering data are given.

### METERS AND INSTRUMENTS, MECHANICAL

**T16** **TACHOMETER**—James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa. Bulletin No. 31-35 features the new Miniature **Frahm** resonant-reed tachometer. Ranges and prices are included.

**T17** **INSTRUMENTS AND CONTROL VALVES**—Fischer & Porter Co, Hatboro, Pa. 24-page booklet No. 50 describes a wide variety of primary and secondary flow instruments and control

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Under all conditions the proved performance of Tycol lubricants more than meets their recommended service.

Rigidly controlled and tested during manufacture . . . and refined from the highest grade crudes, Tycol oils and greases are known for their *UNIFORMITY within each classification — from the first drum to the last.

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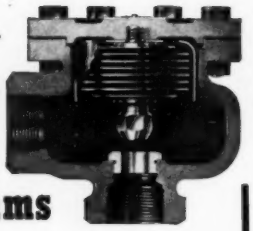
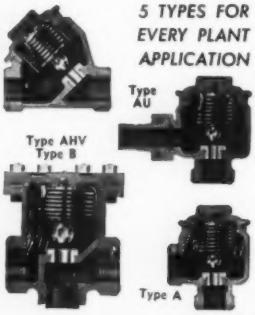
*Are Being Adopted in*

**Advanced PLANT ENGINEERING Programs**



The repeated adoption of Nicholson steam traps in plants with big "cost-reduction-through-modernization" programs is a noteworthy indication of their advanced features. For instance, where manufacturing is put on a continuous basis Nicholson traps help maintain essential operating conditions because they: 1) operate on lowest temperature differential for faster action; 2) eliminate adjusting valves for varying pressures; 3) prevent air-binding; 4) furnish 2 to 6 times average drainage capacity. Size ¼" to 2"; press. to 225 lbs.




*Catalog 448 or see Sweet's*

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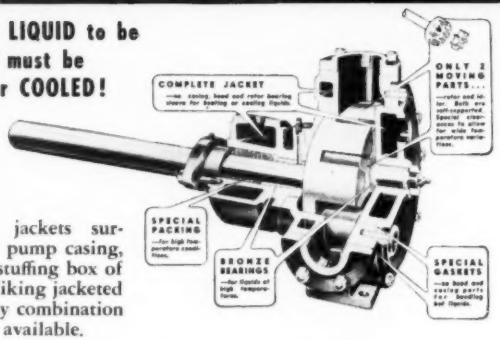
**When the LIQUID to be HANDLED must be HEATED or COOLED!**




Complete jackets surround the pump casing, head and stuffing box of the new Viking jacketed pump. Any combination of jackets available.

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See Our Catalog In SWEETS

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valves for all industries. New features, construction details, typical installations and dimensions are furnished.

**T18** **INDICATING AND RECORDING THERMOMETERS** — Electric Auto-Lite Co, Instrument & Gauge Div, Toledo 1, Ohio. Folder discusses Auto-Lite indicating and recording thermometers. Also contains descriptions and specifications for five different types of thermometers, as well as bulbs and fittings.

**T19** **FURNACE INDICATOR**—Ess Instrument Co, 96 S Washington Ave, Bergenfield, N. J. Single-sheet No. 441-B tells about Cat's Eye furnace indicator that comprises a pyrex hemispherical lens, which reflects flame characteristics. Several models are diagrammed.

**T20** **$CO_2$ ANALYZER**—Charles Engelhard Inc, 850 Passaic Ave, East Newark, N. J. 4-page leaflet No. 710 stresses importance of efficient furnace combustion and explains the way Engelhard $CO_2$ analyzer measures $CO_2$ content of flue gas to help keep air supply at an optimum level.

## PIPING, FITTINGS, VALVES AND SPECIALTIES

**U17** **TUBE FITTING CHART**—Parker Appliance Co, 17325 Euclid Ave, Cleveland 12, Ohio. An 8½x11-in. display card conveniently lists nomenclature for 14 tube fittings shapes and five fittings parts. Shapes are illustrated and described.

**U18** **SWIVEL JOINTS** — Chiksan Co, Brea, Calif. 4-page folder is replete with dimensions, component parts and price list of several styles of Chiksan ball-bearing high-temperature swivel joints.

**U19** **SAFETY HEADS, CHEMICAL FEEDERS AND VENT VALVES**—Black, Sivalls & Bryson Inc, 720 Delaware, Kansas City 6, Mo. 8-page booklet covers safety heads, safety-head flanges, safety-head rupture disks and relief valves, automatic chemical feeders, and pressure vacuum vent valves. Charts give capacities, ratings and specifications.

**U20** **LIGHT-WEIGHT PIPE**—Taylor Forge & Pipe Works, P O Box 485, Chicago 90, Ill. 4-page bulletin No. 193 shows sizes and wall thicknesses available for Taylor Spiral-Weld Pipe as well as fittings and flanges intended for use with this pipe.

**U21** **CAST-STEEL VALVES**—Lukenheimer Co, P O Box 360, Annex Station, Cincinnati 14, Ohio. 12-page circular No. 552 illustrates construction features of a steel valve design that prevents bonnet joint leakage on high-pressure, high-temperature installations.

**U22** **FLEXIBLE METAL HOSE**—Atlantic Metal Hose Co, 123 W 64th St, New York 23, N. Y. Brochure No. 100 gives information relating to new uses for existing types of flexible metal hose; and development of new types of hose to meet problems encountered by Atlantic's engineering dept. Test tables, installation methods and applications are included.

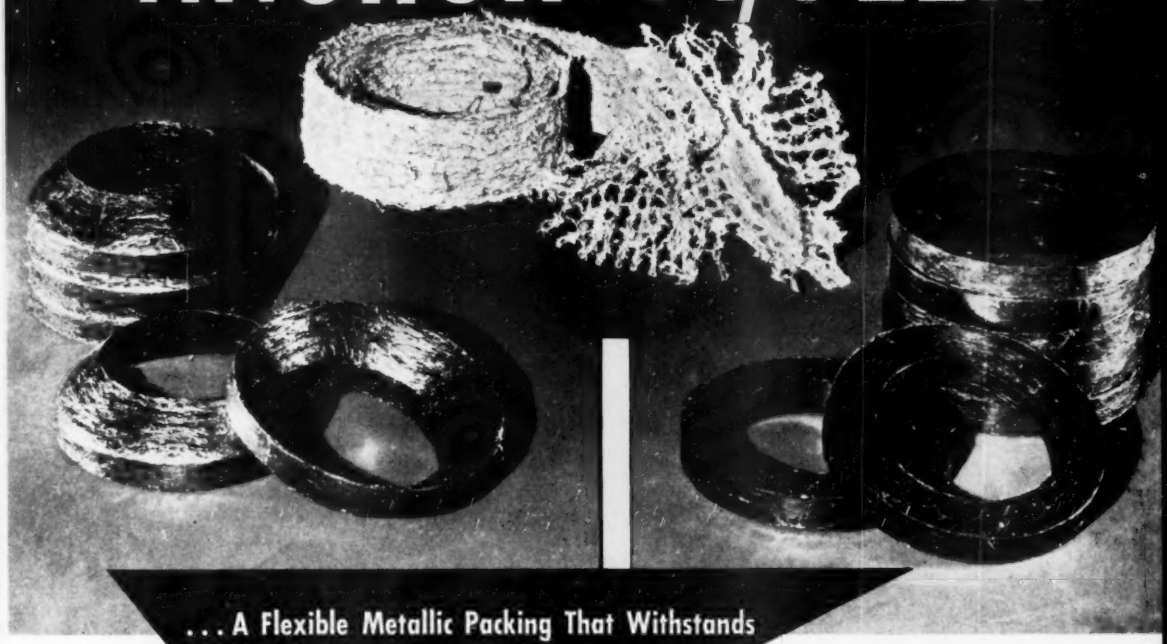
**U23** **TUBE FITTINGS**—Parker Appliance Co, 17325 Euclid Ave, Cleveland 12, Ohio. 60-page catalog No. 203 presents design, specifications, materials and general dimensional data for each of four types of Parker fittings for hydraulic and fluid-handling systems.

**U24** **ROTATING JOINTS** — Chiksan Co, Brea, Calif. 4-page leaflet discusses Chiksan ball-bearing, high-temperature rotating joints. Photos, diagrams and tables are given.

## PRIME MOVERS AND ACCESSORIES

**V3** **DUAL-FUEL ENGINE**—Worthington Pump & Machy Corp, Publications Dept, Harrison, N. J. 16-page bulletin No. S500-R45 introduces new improvements on Worthington dual-fuel diesels. Dual-plunger fuel pump and

# ANCHOR VY/FLEX



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- WATER COLUMN GASKETS
- TAR
- ASPHALT AND ACID PUMPS
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QUALITY in world famous W-S Forged Steel Fittings starts with proper selection of basic metals. Long before problems of forging, machining and testing arise, W-S technicians concern themselves with end uses in the determination of proper steel analysis for the various jobs Fittings must perform.

For example, working closely with Refinery engineers, W-S technicians helped establish standards for the physical properties of various fittings alloys . . . were first to use fitting materials of closely controlled uniformity (low sulphur-low phosphor) for the special demands of refinery services.

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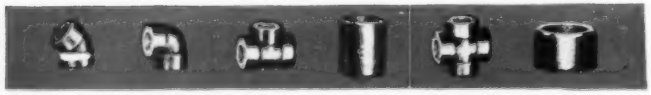
• ESTABLISHED 1848 •

9-J-34



SOLD THROUGH LEADING DISTRIBUTORS

automatic thermal air control, now standard equipment on these diesels, are fully described and illustrated.

**V4 ENGINE-GENERATOR SETS**—International Diesel Electric Co, 13-02 44th Ave, Long Island City 1, N. Y. 4-page folder No. 112 covers the company's line of diesel and gasoline engine-generator sets designed for emergency or continuous service. Sets range from 5 kw to 250 kw.

## PUMPS

**W14 CENTRIFUGAL PUMP** — Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis. 24-page booklet No. 08B6146A gives construction features of Allis-Chalmers Type S, single-stage, double-suction centrifugal pump. Bulletin also carries tables of available sizes, approximate dimensions and head capacities, tells how to figure pumping head, and tabulates friction loss for water per 100 ft of pipe.

**W15 OPPOSED IMPELLER PUMPS** —De Laval Steam Turbine Co, Trenton 2, N. J. 12-page catalog No. 1550 discusses De Laval opposed impeller pumps available in pressures to 1000 psi. Also, complete description of both 2- and 4-stage units, rating and dimension tables are included.

**W16 MECHANICAL VACUUM PUMPS**—Kinney Mfg Co, 3529-41 Washington St, Boston 30, Mass. Leaflet, entitled "Use of Mechanical Vacuum Pumps in Central Station Operation," explains the use of mechanical rotary vacuum pumps on steam condensers. Detailed diagrams are given.

## WELDING

**Y6 ALLOY WELDING HINTS** — International Nickel Co Inc, 67 Wall St, New York 5, N. Y. 32-page technical bulletin T-2 relates all the different methods of welding, brazing and soft soldering monel, nickel, Inconel, and other alloys. Also contains many diagrams and technical data.

**Y7 ARC-WELDING ACCESSORIES**—General Electric Co, Schenectady 5, N. Y. 20-page booklet No. GEC-253A gives descriptions, specifications, and prices of more than 150 arc-welding accessories available from General Electric.

**Y8 WELDING HOSE**—B F Goodrich Co, Akron, Ohio. Catalog section No. 4200 illustrates the company's Oxy-Acetylene and Duo-Weld hose. Construction data and specifications are given.

**Y9 METALLIZING GUN**—Wall Colmonoy Corp, 19345 John R St, Detroit 3, Mich. 4-page folder describes the Colmonoy Spraywelder, a powder metallizing gun, and the spraying of powdered Colmonoy No. 6, No. 5 and No. 4 alloys, as well as other powdered metals.

## OTHER EQUIPMENT

**Z13 ABRASIVE-RESISTANT METAL** —Electro-Alloys Div, American Brake Shoe Co, Elyria, Ohio. 6-page broadside, entitled "How to Reduce Abrasive Wear with Thermalloy HC-250," discusses the physical properties of Thermalloy HC-250, listing the many uses and advantages of this abrasive-resistant metal.

**Z14 PHOTOELECTRIC CELLS** — International Rectifier Corp, 6809 S Victoria Ave, Los Angeles 43, Calif. 4-page bulletin No. PC-649 furnishes diagrams, curves, construction details, performance characteristics and applications of selenium self-generating photoelectric cells. Price list is included.

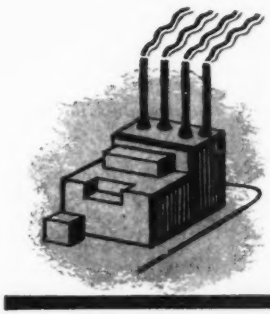
**Z15 WATER CONDITIONING**—Elgin Softener Corp, Elgin, Ill. 20-page booklet No. 610 tells the water-conditioning story—where it may be used profitably and why. Also contains up-to-date information on design and application of water-conditioning equipment.

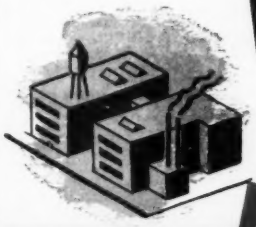
(*Continued on page* 192)

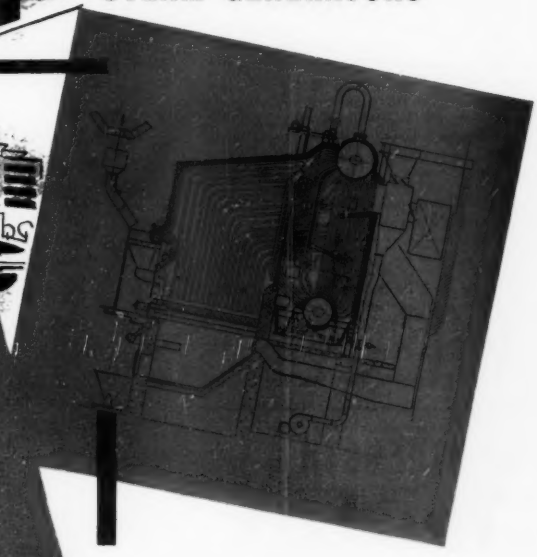
FOR EVERY INDUSTRY...

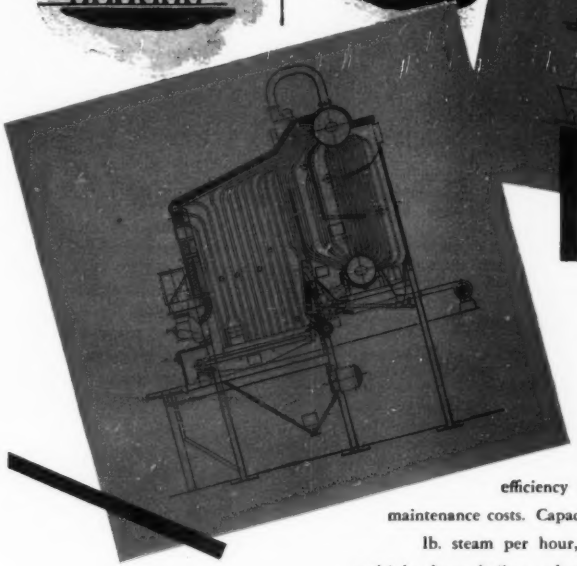
# WICKES

## 2-DRUM STEAM GENERATORS









The two engineers's drawings shown here are typical of the Wickes two-drum steam generators being installed in industries and public buildings of all kinds. Wickes Boilers are operating at an extremely high degree of efficiency and owners' records show very modest maintenance costs. Capacities of Wickes Boilers are up to 250,000 lb. steam per hour, pressures up to 850 psi. All types of multiple drum boilers, adaptable to any type firing. Contact your nearest Wickes representative or write our engineers in Saginaw.

## THE WICKES BOILER CO. SAGINAW, MICHIGAN, U. S. A.

DIVISION OF THE WICKES CORPORATION

SALES OFFICES: Atlanta • Boston • Charlotte, N. C. • Chicago • Cincinnati • Denver • Detroit • Fort Worth, Texas • Indianapolis • Jacksonville • Los Angeles • Milwaukee • New York City • Peoria, Ill. • Pittsburgh • Saginaw • San Francisco • San Jose, Calif. • Seattle • St. Louis • Tulsa, Okla. • Mexico City

# HELP!

FOR EVERYONE WHO HANDLES VALVES OR PIPING

**Babbitt**
*Adjustable*
SPROCKET RIM
*with Chain Guide*

● Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

● Control overhead valves with ease and certainty, no matter how high up—right from the floor! No more climbing on bench, machine, boiler, treacherous stepladder. For overhead pipe layouts, plan on putting valves wherever needed. The BABBITT Adjustable Sprocket Rim with Chain Guide is especially designed for easy, positive control of those out-of-reach valves—from the floor.

● The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

● *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

**BABBITT STEAM SPECIALTY CO.**
**1 Babbitt Square, New Bedford, Mass.**

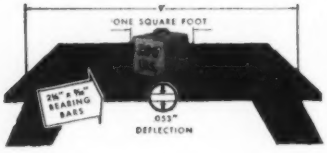


For **STRENGTH** specify

# TRI-LOK

RECTANGULAR

## OPEN STEEL FLOORING




The locked-in strength of Tri-Lok enables it to stand up under heavy loads—even on long spans. No rivets, bolts, or welds are used in the construction of Tri-Lok; this feature eliminates the possibility of loose joints.

Tri-Lok is also available in Diagonal, or Super-Safety U-type Flooring, and in Stair Treads of all types. Write for Bulletin KM 1140.

**DRAVO CORPORATION**

National Distributor for the Tri-Lok Company

**Dravo Bldg., Pittsburgh 22, Pa.**

Sales Representatives in Principal Cities

DRAVO


**Z16 FIELD SERVICE UNIT**—Davey Compressor Co, Kent, Ohio. Single-sheet No. E-232 features Davey's new truck-mounted field service unit, Type PW-308. A floor plan shows location of welder, generator, compressor, power-lubrication equipment and supplementary items.

## POWER NEWS

(*Continued from page 132*)

in 1946 at Oak Ridge National Laboratory, Oak Ridge, Tenn. For the past half year, it has been carried on jointly by Oak Ridge Laboratory and Argonne National Laboratory, Chicago, Ill. Therefore, the architect-engineer for the new reactors will work closely with these two laboratories.

### Elliott Co Acquires Crocker-Wheeler

The acquisition, by Elliott Co, as of Sept 16, of the business and assets of Crocker-Wheeler Div of Joshua Hendy Corp had been announced by Grant B Shipley, chairman of the board of Elliott Co, Jeannette, Pa.

Elliott Co, whose president is W A Elliott, was organized in 1901 and is now a leading builder of steam, power and electric equipment for process plants. Elliott plants are at Jeannette, Pa.; Ridgway, Pa.; Springfield, Ohio; and Newark, N. J. Ridgway Div manufactures large electric motors and generators and is an outstanding supplier of submarine propulsion equipment and rotating machinery for large electric generating stations.

With the addition of the Crocker-Wheeler Div, Elliott Co now has a complete line of ac and dc motors ranging in size from one hp up to 25,000 hp. Formerly, Elliott Co line of equipment did not include motors under 200 hp.

Charles A Butcher had been elected a vice-president of Elliott Co, effective Sept 16. According to Shipley, Butcher will continue to function as general manager of Crocker-Wheeler.

Mr Butcher is a native of Iowa and received his BS and EE degrees from Iowa State College. He has more than 30 years of experience in many phases of the electrical field and has several patents to his credit, including an automatic switch for controlling circuit breakers, which is used throughout the world in power-supply apparatus for electric railway systems. He has been identified with design and manufacture of power-supply apparatus for numerous American and foreign electric railway and power systems.

**Edward Valves, Inc,** East Chicago, Ind., has new metallurgical, physical and chemical laboratories in operation. Manned by skilled laboratory engineers, these new laboratories will be used for extensive research and development work on Edward and Nordstrom steel valves.


# SOOT REMOVAL

● You can remove soot from furnace heat transfer surfaces quickly and completely with Nalco SR Chemicals — *while the boiler is on line and in full operation!* You save fuel with clean fire-side conditions; and Nalco SR Chemicals help to keep boilers on line longer, cut maintenance time and materials, and eliminate smoke nuisance while they work . . .

# SLAG ALLEVIATION

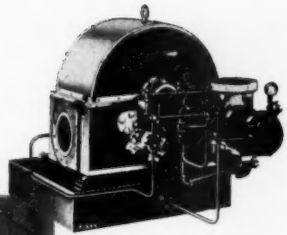
● What is the cost of boiler outage where furnace slagging is a problem? Ask to see whether Nalco SR Chemicals can help you . . . On most slags, Nalco SR Chemicals lower specific gravities to 0.6 — 0.7; make slag spongy and friable so that it falls away or comes off easily . . . Nalco SR-155, a combustion catalyst for oil-fired furnaces, keeps sludge dispersed in tanks and fuel lines; prevents nozzle gumming and clogging and *removes soot.*

Write today for complete data: NATIONAL ALUMINATE CORPORATION, 6222 W. 66th Place, Chicago 38, Illinois. *Canadian inquiries should be addressed to Alchem, Limited, Burlington, Ontario.*

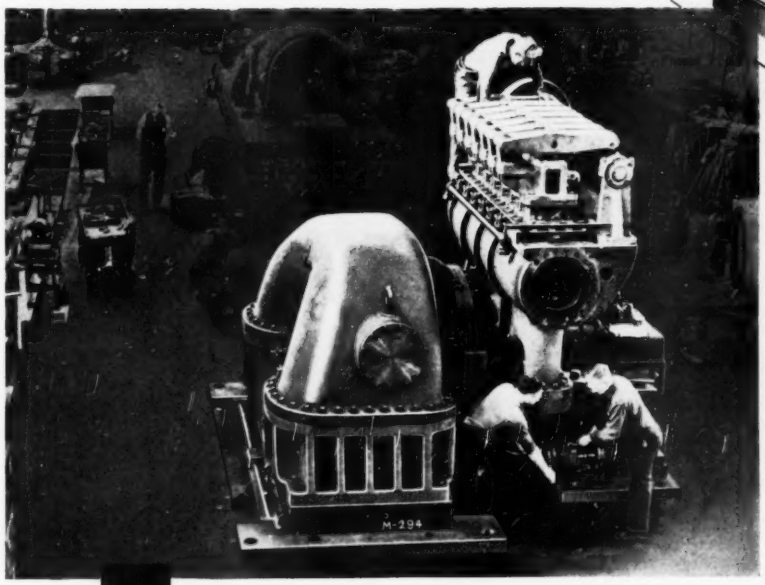
WITH *Nalco*

# SR SERIES CHEMICALS

Compact, sturdy, dependable. A Worthington single-stage, centrifugal compressor-drive turbine.



# FROM SMALLEST SINGLE-STAGE TO MULTI-STAGE GIANTS




A standout for size. One of two Worthington 24,000 hp centrifugal compressor-drive turbines during assembly.

## Worthington Turbines Meet the Broadest Range of Drive Requirements

Worthington Turbines offer you unlimited choice of sizes and types — including straight condensing, straight non-condensing, extraction, mixed pressure extraction, low pressure and high back pressure. Steam or gas driven, for mechanical or generator drive, all are available with governors for constant or variable speed, with optional governor-control.

**LOWER-COST BLOWER AND COMPRESSOR OPERATION**

In the complete Worthington line you'll find the *right* speeds and horsepowers to keep your blowers, compressors and other mechanical drives operating at peak efficiency. And since each Worthington Turbine — from the smallest to the largest — is designed to make steam do more work, you can count on steady power- and money-saving throughout a long, trouble-free service life.

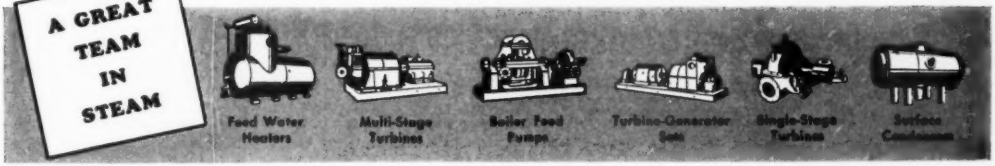
Get the whole story of this economical, always dependable power from your nearest Worthington representative. Or for further facts proving *there's more worth in Worthington*, write to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.*

**WORTHINGTON**

**STEAM TURBINES**

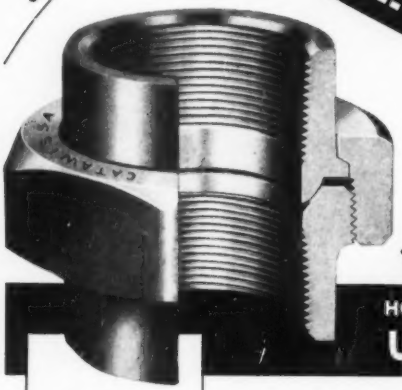
T9-3

**A GREAT TEAM IN STEAM**



CATAWISSA

BALL-TO-ANGLE SEAT gives you a PERFECT SEAL...



. . . even when the pipe is not perfectly aligned!

CATAWISSA

HOT FORGED STEEL UNIONS

Full ACME Threads or U. S. Standard V-Threads in Union nuts and on female end.

STANDARD AND DOUBLE EXTRA HEAVY

HOT FORGED from solid, rectangular steel bars, Catawissa Pipe Unions are free from sand and blow holes. The ball-to-angle seat design plus their ability to expand and contract with the pipe give you sure fire dependability . . . a perfect seal for every application!

CATAWISSA

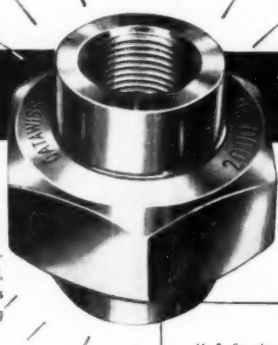
STAINLESS STEEL UNIONS

*a type for every use!*

MACHINED FROM SOLID STAINLESS STEEL BARS

Types 304, 316 and 347

Wherever caustic solutions are piped, Catawissa pipe union dependability is now available in corrosion-resisting Stainless Steel!



U. S. Standard V-Threads in Union nuts and on female end.

STANDARD AND DOUBLE EXTRA HEAVY

You specify the use and application. Catawissa will furnish a Stainless Steel Union recommended and guaranteed to give satisfaction! Standard and Double Extra Heavy types carried in stock. Specials made to order for socket welding, orifice plate, male-female or any other special use required!

*IF IT'S A CATAWISSA . . . IT'S DEPENDABLE!*

SEE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR . . . or write direct for complete engineering data and your copy of BULLETIN 10-A.

CATAWISSA VALVE & FITTINGS CO.

206 Mill St. • CATAWISSA, PENNSYLVANIA

## 7,000,000 Hp on Hamilton River, in Labrador

Hamilton River, in Labrador, is one of the largest sources of water power in Canada. Recent studies indicate that the drop is 1038 ft in the 16-mile Grand Falls section. Of this drop 219 ft is in the 4-mile rapids above the falls; 245 ft in the falls and 574 ft in Bowdoin Canyon.

Drainage area above the falls is 21,500 sq mi, which would give 32,000 cfs flow, assuming 1.5 cfs per sq mi. This would justify installing 4,750,000 hp of power-generating capacity. Muskrat Falls, with a drainage area of 29,300 sq mi and 180-ft head, will require an installation of 1,130,000 hp of turbines. The fall between Grand Falls and Muskrat would produce about another 1,000,000 hp. These projects total nearly 7,000,000 hp without considering power possibilities on tributaries of the Hamilton.

This great power source is at a disadvantage because it is so far away from large power markets. It is 460 mi from Grand Falls to Arvida, Que., the great aluminum refining center. Other distances are 230 mi to the Gulf of St. Lawrence, 160 mi to Goose Bay, 115 mi to the Hollinger iron mines, and 280 mi to the Labrador coast.

Practical transmission distances are always increasing. The longest line at present is from Boulder Dam to Los Angeles, Calif., 287 mi, operating at 285,000 v. A short experimental line has been tested at 440,000 v. Transmission at this voltage would be good for up to 500 mi.

Some day a use will be found for this great power. Pioneering men and women will move northward and another frontier will be rolled back.

**Hendley Blackmon,** managing editor of *Electrical World* since 1947, has been appointed assistant manager of engineering association activities for Westinghouse Electric Corp. He will be headquartered at the East Pittsburgh Works. H N Muller, assistant to vice-president, said that Blackmon will assist Frank Thornton Jr, manager of engineering association activities. He will work with Westinghouse engineers in preparation of papers to be presented before engineering associations. An electrical engineering graduate of Georgia School of Technology, Blackmon entered Westinghouse in 1925. In 1932 he was named technical editor of the company's Technical Press Bureau. He was appointed manager in 1938, a position he held until 1945 when he resigned to join McGraw-Hill Publishing Co.

**Name of Ralph M Westcott Co,** Los Angeles 15, Calif., has been changed to Water Chemists, Inc. Robert H Savage, formerly vice-president, has become president under the new name. Personnel, equipment and location remain unchanged. The company's condenser cleaning service and chemical engineering supervision on water-treatment problems continue as in previous years. As representatives of Calgon, Inc, on *Micromet*, Water Chemists will continue to distribute this product, together with technical assistance in its use.

# Rubber makes a "pipe" dream come true

For years industrial men have been seeking ways to make heavy pipe absorb vibration and wear longer.

Now Hewitt engineers have the answer to this production "pipe" dream . . . a way to reduce replacement costs!

The answer is Hewitt steel-wire-reinforced Flexible Rubber Pipe. This pipe has proved so resistant to harsh abrasive materials that it has doubled and tripled the service life in many installations. What's more, it often costs no more to begin with!

This versatile pipe is being used to carry gritty, abrasive materials in ash disposal systems at power plants . . . high phosphate-content material as well as strong acid and alkali solutions at chemical plants . . . slurries in coal and metal mines . . . and for many other solids-in-solution handling jobs.

H-R Flexible Rubber Pipe is easy to handle and couple. You can curve it and flex it, thus often eliminating costly elbows.

It can be made to resist abrasive actions, to withstand oils, and to stand up against the acids and chemicals that normally attack other materials. And, of course, it won't rust.

For full information on how Hewitt Flexible Rubber Pipe can be applied to your own needs, phone the Hewitt Distributor listed in the classified section of your phone book. Or write direct to Hewitt Rubber Division, 240 Kensington Ave., Buffalo 5, N.Y.

**HEWITT**

**INDUSTRIAL HOSE**

**HEWITT RUBBER DIVISION**

## Hewitt-Robins Products for Industry

***Hewitt Rubber Division***

Conveyor Belting • Elevator Belting • Hot Materials Belting • Transmission Belting • Air Hose • Welding Hose • Steam Hose • Water Hose • Fire Hose • Sand Blast Hose • Suction Hose • Acid Hose • Gasoline Hose • Chemical Hose • Rubberlokt Rotary Wire Brushes

***Robins Conveyors Division***

Screens • Screen Cloth • Shakeouts • Conveyors • Idlers • Car Shakeouts • Dewaterizers

***Robins Engineers***

Design and construction of complete bulk materials handling systems.

**HEWITT-ROBINS** HR **INCORPORATED**

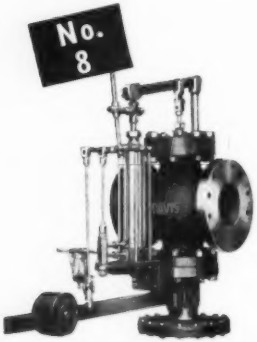
—everything YOU want in

# PRESSURE REGULATORS

## The DAVIS Line is Complete!

**No. 401**—Designed to give you everything you want in a sensitive diaphragm motor valve and pressure controller for pressure reducing service on steam, air, or gas. The controller may be mounted on the valve or installed remotely on an instrument panel. The valve is a spring loaded, balanced disc type of rugged construction suitable for indoor or outdoor installation. Offered in a complete range of sizes from ½" to 10" for initial pressures to 600 p.s.i. and any reduced pressure from 500 down to 1 p.s.i. Ask for descriptive literature.

**No. 40**—This is a simple, self-contained, pilot operated type reducing valve for handling heavy, variable loads on steam or air. Unaffected by high pressure fluctuations, pressure reduction is maintained regardless of flow conditions. Full pipe size port area gives large capacity; single seat insures tight closing. Sizes from ½" to 6". Available in materials suitable for any initial pressure up to 400 p.s.i.




**No. 8**—Built for handling steam at pressures ranging as high as 600 p.s.i. Pilot controlled and weight loaded, with auxiliary operating cylinder, this valve provides exceptionally accurate regulation for reduced pressures from 0 to 300 p.s.i. Sizes from 2" to 24".

Let Davis help you get the right regulator for the job. The Davis line is complete . . . 18 types to choose from . . . ask for Bulletin No. 100 A.

**DAVIS REGULATOR COMPANY**
2540 So. Washtenaw Ave., Chicago 8, Ill.

## NEW EQUIPMENT BRIEFS

(*Continued from page* 182)

**P1171 • EXTENSION REEL** — *Port-O-Reel* eliminates most of the ordinary electric cord wear with resulting longer cord life. New model accommodates 150 ft of No. 16, 2-conductor cord or its equivalent in diameter.

Rewinding is handled at a rate of about 10 ft per sec. Although reel weight has been reduced to only 9 lb and height to 17⅜-in. frame has actually been strengthened by design change.
**Industrial Electrical Works, 1509 Chicago Street, Omaha 2, Neb.**

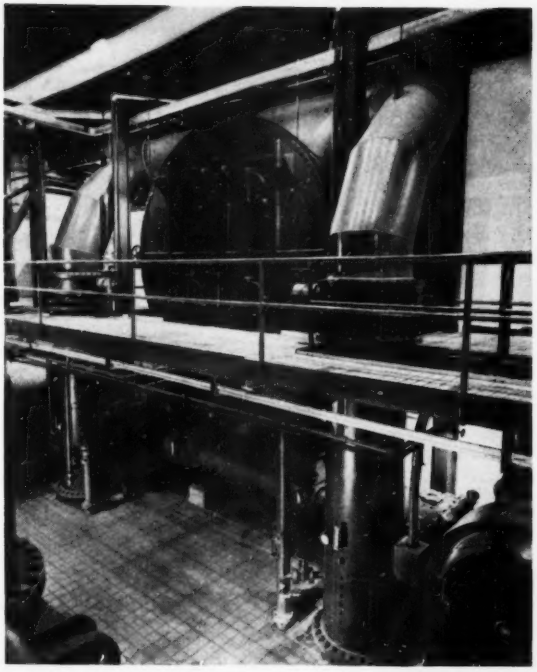
**P1158 • MOTOR STARTER**—Type 371 starter is for service in chemical, coal handling and other industries where corrosive vapors or combustible dust-laden atmospheres are present. Device has its entire mechanism immersed in oil and is designed for use with squirrel cage and the primary of wound rotor motors of 350 hp or less at 2.3 kv. It is actuated by a pilot device, such as pushbuttons, float or pressure switches.
**Allis-Chalmers Mfg Co, Milwaukee, Wis.**

**P1172 • LOW-COST WELDERS** — Line of low-cost dc arc welders meets demand for lower-priced equipment. Unit shown is motor-driven Model *MZ-200-S*, rated 200 amp at 30 v on 50%-duty cycle.

Current range is from 40 to 250 amp at an operating speed of 3450 rpm. It is 26¼ in. long, 18 in. wide, 25 in. high (stationary), and weighs 340 lb. Generator is a modified multirange type with four laminated main poles and four interpoles that are removable. Four heavy-duty generator brushes are held in a fixed neutral position by patented single-unit brush rigging.

Modified multirange dual control offers five ranges of welding current and 100 steps of va adjustment in each range, making available 500 combinations of open-circuit voltage and welding current for selecting any desired arc characteristics.
**Hobart Brothers Co, Box 489, Troy, Ohio.**

**P1173 • NEGATIVE SPRING**—Secret of the *neg'ator* lies in prestressing each successive increment of length of a flat strip of spring stock by a predetermined



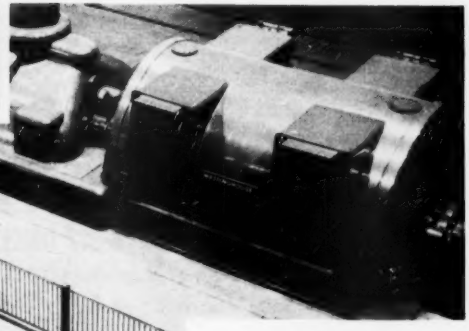
# CONSECO 33,000 SQ. FT. CONDENSER

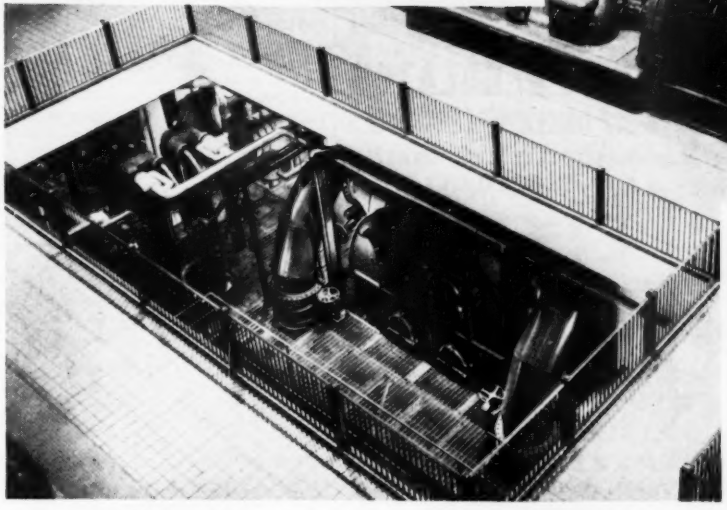
**Special Feature — Deaerating Hotwell . . . Deep-Water Boxes . . . Large Access Manholes**

33000 sq. ft. Divided Flow Condenser. Design based on 100% tube cleanliness and design performance guarantee exceeded in operation. Full Deaerating Hotwell utilized eliminating Deaerating Heater from plant heating cycle.

•

CONSECO Engineers are specialists on Condensers and Heat Exchange equipment. Every condenser designed and built by us has fully met and exceeded guarantees. The services of this young, progressive organization are at your disposal.





**CONDENSER SERVICE & ENGINEERING CO. INC.**

HOBOKEN, N. J.

CONSECO

## PRODUCTS

Boilers and Pressure Vessels
Condensers, Evaporators, Heaters
Coolers (All Types for All Services)
Pumps (Plunger and Centrifugal)
Unit Heaters
Steam Engines
Filters and Strainers
Centrifuges
Barges, Boats, Tugboats

## SERVICES

Engineering
Designing
Retubing anything with tubes
Instrument Repairs — All types and makes
Welding — Stress Relieving
X-Ray — Metal Spray
Engine Repairs
Compressor Repairs
Overhauling and erecting of plant equipment

## PLANTS AND MANUFACTURING FACILITIES

**Scranton, Pa.**
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**Elizabeth, N. J.**
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**Raritan, N. J.**
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**For Retubing and Maintenance Service — Call Our Field Office Day or Night — N. J. HOboken 3-4428, N. Y. REctor 2-9363**

# LEAK DETECTORS

*find leaks quickly*

With G-E leak detectors you can easily locate even the smallest leaks in closed systems. Detectors are ideal for locating leaks in installed equipment or in the products you make.

Use the Type H detector for pressure systems, the Type M for evacuated systems.* Write for Bulletin GEC-233 (Type H) or for GEC-336 (Type M). *Address Apparatus Dept., H687-21, General Electric Co., Schenectady 5, New York.*

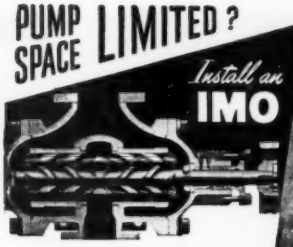
**If the system is filled with combustible gas, write for special application information.*

GENERAL ELECTRIC

GEC-21

PUMP SPACE LIMITED ?

*Install an* IMO



- The capacity of the IMO is increased by high speed operation. This compact pump can be directly connected to the driving machine without bulky speed reduction gearing.
- IMO Pumps can be furnished for practically any capacity and pressure required for oil, hydraulic-control fluids and other liquids.

*Send for Bulletin 1-146P*

IMO PUMP DIVISION of the DE LAVAL STEAM TURBINE CO TRENTON 2, NEW JERSEY

# HENSZEY *Boiler Feed* REGULATOR

*Keeps a* WATCHFUL EYE *on* BOILER WATER LEVELS

• CONTINUOUSLY • AUTOMATICALLY • ACCURATELY

*under* ALL LOAD CONDITIONS

They help avoid the hazards of high, as well as low, water levels. They function night and day—once installed and set for operation no attention is necessary — nothing to get out of order — nothing to rust. A simple, compact unit — installs right in the line — no additional supports are necessary. Pressures up to 600 lbs., sizes up to 4 in.

***Send for bulletin.***

HENSZEY COMPANY

DEPT. D11, WATERTOWN, WISCONSIN

HENSZEY

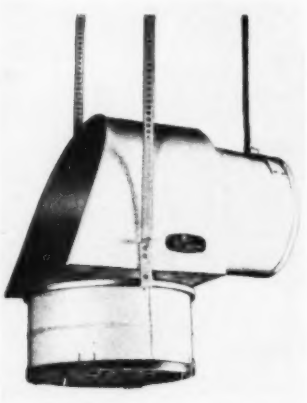
# BOILER FEED REGULATORS

**Continuous Blowdown • Distillation Systems • Heat Exchangers**
**Feed Water Meters • Flow Indicators • Proportioning Valves**
**also MILK EVAPORATORS and PRE-HEATERS**


amount. In its relaxed position the *neg'ator* forms into a tight coil.

Its resisting force is developed as each successive length of the metal strip is drawn off the coil. The force required to do this varies inversely as the radius to which the metal strip has been prestressed at that point. Only that short section of the stock that lies in the partially straightened zone between tight coil and fully straightened tail produces a resisting force at any time.

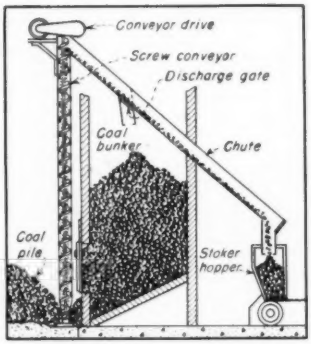
**Hunter Spring Co, Landsdale, Pa.**



**P1174 • HUMIDIFIER** — New Model 30 industrial humidifier employs 230 watts of electrical energy to vaporize about 3 gal per hr of water.

All that is needed are connections to city water and electric energy. There are no compressors, air or drain piping or duct work. Units may be used in multiple if desired.

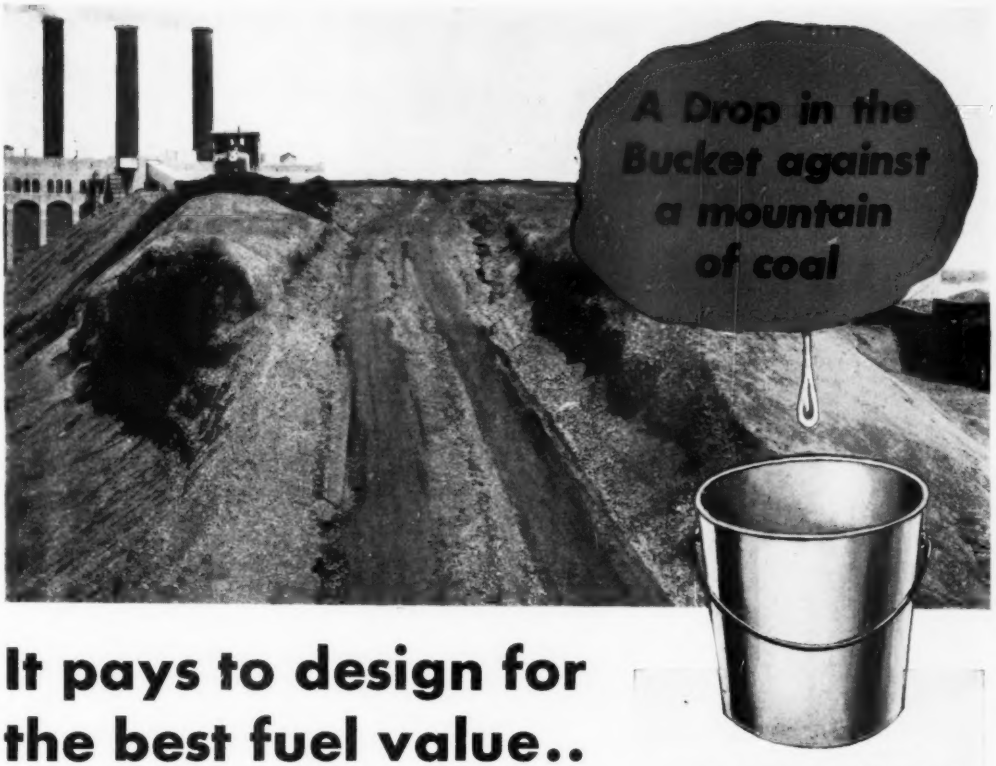
**Walton Laboratories, Irvington 11, N.J.**




**P1175 • SCREW CONVEYER** — As shown above, one vertical screw conveyer fills the bunkers and feeds the stockers. Coal is dumped into pit beside building, fills the bunkers and feeds the stokers, as desired. Same conveyer also transfers coal from bin to stoker.

**Baughman Mfg Co, Jerseyville, Ill.**

*(Continued on page 200)*




# It pays to design for the best fuel value..

Compared with the amount you will spend for fuel, equipment costs are literally *a drop in the bucket.*

Coal cost during the life of the plant is from ten to fifteen times the capital investment required for a new plant designed for complete fuel flexibility.

Let the Fairmont Coal Bureau engineers prove how an additional capital investment to provide fuel flexibility pays out in little more than a year and earns handsome dividends for years to come.

## FACTS about FAIRMONT Low Fusion Coal

. . . can be burned efficiently in any equipment properly designed for its use.

. . . it will be available for many years to come because of its tremendous reserves.

. . . It is available on three originating railroads.

. . . it usually represents "the best value for the fuel dollar," for long-range planning.

## *Mail Coupon Today!*

Fairmont Coal Bureau, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

Kindly place my name on your mailing list to receive copies of your publications and Technical Reference Bulletins.

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Company ..... Nature of Business .....

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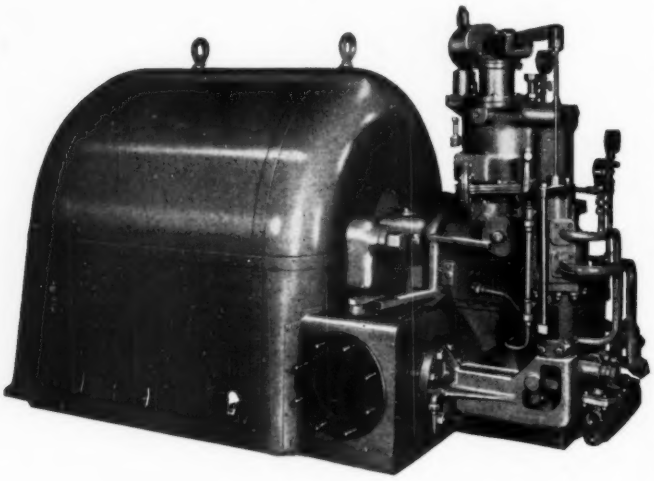
FAIRMONT COAL BUREAU · SERVICE TO INDUSTRY · FAIRMONT REGION WEST VIRGINIA

PT149

# MURRAY
## TYPE UV



# MULTI-STAGE STEAM TURBINES

**Simplicity and reliability characterize the Murray Type UV Turbine. Available in from two to ten pressure stages on two basic pitch diameters. The Type UV can be supplied in capacities from 100 to 4000 HP, condensing or non-condensing. It can be used for mechanical drives or for smaller generator drives.**

**Murray Type UV is durably built for dependable performance. Horizontally split case construction to suit operating conditions. Blades are stainless steel, shafts of alloy steel. The assembled rotors are dynamically balanced. Governors are provided to suit specific job requirements.**

*Let our engineers cooperate in smoothing out your power problems.*

WRITE FOR BULLETIN T-122

**MURRAY IRON WORKS COMPANY**

**BURLINGTON, IOWA**

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY


## NEW EQUIPMENT BRIEFS

**P1124 • WELDING ELECTRODE**—Manganese steel welding may be easily handled with *Eutectrode* 4/49 for ac or dc.

The electrode produces long life welds on manganese without cracking. It withstands high impact and has a Rockwell hardness of C26-34. Electrode is available in 3/16, 5/32 and ⅛ in. sizes.

**Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N.Y.**

**P1149 • WEATHERPROOF BELL**—Bell mechanism consists of a solenoid coil in which a loose-fitting plunger operates. Unit is supported by a glazed-porcelain terminal block mounted in a cast-aluminum back box.

Bells are designed for surface mounting and supplied in 8-, 10-, and 12-in. sizes for operation on 3 to 250 ac or dc.

**Autocall Co, Shelby, Ohio.**

**P1135 • AUTOMATIC BOILER**—Self-contained, automatic *Amesteam* steam generator has been built for pressures from 15 to 200 psi in one capacity, 1600 lb, for oil or gas firing.

Furnace and tubes are arranged for smooth flow of gas over heating surfaces. Commercially dry steam can be produced from a cold start in 20 to 30 min.

**Ames Iron Works, Oswego, N.Y.**

**P1108 • AUTOMATIC CLUTCHES**—Fractional and small-horsepower automatic clutches are adjustable on the job for a wide range of capacities and other drive characteristics. They are used on motors or engines to make starting easy and can be adjusted for rate of load acceleration by adjustment of friction shoes and springs.

**Centric Clutch Co, Cranford, N.J.**

**P1157 • HANDY SOLVENT**—*Kroil* creeps into small spaces to dissolve dried oils, rust and corrosion and to supply the necessary lubrication to loosen a frozen part. Liquid comes in squirt-gun for application to a frozen bolt, nut or bearing.

**Kano Laboratories, 75 E Wacker Dr, Chicago 1, Ill.**

**P1145 • HOSE**—*Peerless* buna N synthetic rubber hose handles kerosene, fuel oil and other petroleum distillates. Hose has neoprene cover and two stranded, annealed copper wires to dissipate static electricity.

**United States Rubber Co, Rockefeller Center, New York 20, N.Y.**

**P1138 • RELIEF VALVE**—Freon relief valve *CGA*1½.2 has been thoroughly tested and found acceptable by ASME. The valve assures tight seating and permits installation of a safety-head rupture disk on its outlet.

**Black, Sivalls & Bryson Inc, 720 Delaware, Kansas City 6, Mo.**

## ALL MAJOR PUMP PARTS OF

# A. O. SMITH

## VERTICAL TURBINE PUMPS

- **ARE DESIGNED TOGETHER**
- **BUILT TOGETHER**
- **TO WORK TOGETHER**

**A. O. SMITH**—one of America's oldest and largest fabricators of quality steel products—is the *only* vertical turbine pump manufacturer that gives you this important advantage of *undivided responsibility.*

This is your assurance . . . and your customer's . . . of unsurpassed quality control, precision fitting, and years of dependable, low-cost service.

**STEEL WHERE STEEL BELONGS.** A. O. Smith Pump discharge-head assemblies are heavy steel plate, formed and welded into the strongest, most compact design. Driver support is rigid, vibrationless, yet easily accessible. The precision-machined bowls are heavy cast iron. Impellers, of bronze, are semi-open or enclosed.

**WIDEST ADAPTABILITY.** A. O. Smith Pumps are available with Vertical Hollow Shaft Electric Motors, flat pulley or V-belt pulley, and right-angle gear drive. Water or oil lubrication.

Seventy-five years of experience are back of the research and engineering A. O. Smith has built into their pumps . . . to give you a superiority you can *depend on* under the toughest operating conditions.

Send the coupon—today.

**CERTAIN TERRITORIES STILL AVAILABLE**
Write or wire for full details of the A. O. Smith Vertical Turbine Pump distributor's franchise. Send the coupon for our colorful illustrated bulletin.

**A.O.Smith**
**VERTICAL TURBINE PUMPS**

**Atlanta 3 • Chicago 4 • Houston 2 • Los Angeles 14**
**Dallas 1 • New York 17 • Midland 5, Texas**
**Philadelphia 3 • Seattle 1 • San Francisco 4**
**Pittsburgh 19 • Tulsa 3**
**International Division: Milwaukee 1**

A. O. Smith Corporation, Dept. P-1149
Milwaukee 1, Wisconsin

Without obligation, send us your new illustrated descriptive bulletin on A. O. Smith Vertical Turbine Pumps.

Name_____

Street or Route_____ Box_____

City_____ State_____

## Give these eye-opening facts on power systems to the men you depend on for savings

*Up-to-the-minute 'Pack of Facts' points way to many plant economies*

Are all the men in your plant responsible for savings fully aware of the difference that modern *plant power distribution* can make? Do they know how it affects plant layout...productivity...costs? Get the latest facts to them *now!*

IT'S EASY—General Electric, as a service to industry, has prepared the facts for you in visual terms that are easy-to-take...linger in the memory.

**Here's what the power distribution program offers:**

1. **A fact-packed manual** providing up-to-the-minute data on plant power distribution. Objective, *without sales bias*, it helps solve your power problems.
2. **A slidefilm with sound** that tells what load-center distribution is, and what it does. It aids the men who run your plant make money-saving decisions.
3. **Fully illustrated highlights booklets,** for individual study and review.

**Convince yourself first—**

We'd like you to examine the *Load Center Power Distribution Manual* without charge or obligation. Just use the coupon below.

**Showings Cost You Nothing**—With your manual, we'll tell you how to arrange for a FREE slidefilm showing.

Put these facts into the works—and watch them work for you.

**FREE**
**TO BUSINESS MANAGEMENT**

Attach to your business letterhead

General Electric Co.
Section L684-4
Schenectady 5, N. Y.

Please send me a sample copy of the G-E *Load Center Power Distribution Manual* without cost or obligation, with details on how I can arrange a **FREE SHOWING** of the film. (Extra copies at regular manual price—$1.00.)

Name _____ Title _____
Company _____
Street _____
City _____

GENERAL ELECTRIC


## APPOINTMENTS

**Chicago Metal Hose Corp,** Maywood, Ill., names Shelby A McMillion and T K Wells assistants to A S Keller, vice-president in charge of sales. E L Hiter becomes manager of sales for Eastern div, which encompasses sales offices at Boston, New York, Philadelphia, Pittsburgh and Atlanta. Also, A W McGuire is promoted to sales manager for Western div, which covers sales offices at Detroit, Cleveland, St. Louis, Fort Worth, Glendale, San Francisco and Chicago.

John A Rhodes Co, Springfield, Mo., has been appointed by **Globe Steel Tubes Co** as distributor of the firm's seamless welding fittings and flanges.

**Elliott Co** assigns F S Mott as manager of manufacturing at the Ridgway, Pa. division.

Frederick I Lackens retires as advertising manager of **Hays Corp,** Michigan City, Ind. He will make his permanent residence in Fort Lauderdale, Fla.

**Stickle Steam Specialties Co** selects Reliable Sales & Engrg Co, Grand Rapids, Mich., as its representative to cover the state of Michigan with exception of Monroe, Wayne, Oakland and St. Clair counties. All surveys and engineering will be made under supervision of P W Porter, president.

John E Morrison has been appointed district manager in charge of **Link-Belt Co's** new office at 301 W First St, Duluth 2, Minn. He will be assisted by Harold A Ivarson. Territory includes northeastern Minnesota, northern Wisconsin and upper peninsula of Michigan.

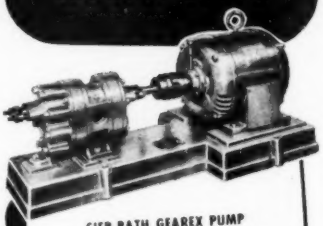
**Vulcan Soot Blower Corp,** Du Bois, Pa., names Joseph Kissick Jr, as assistant chief engineer.

Harry E Lewis is assigned to foreign and export dept, **Worthington Pump & Machy Corp,** Harrison, N. J. George Bourque succeeds Lewis as works comptroller at Holyoke, Mass. works.

**Westinghouse Electric Corp,** reports following changes in its personnel: J C Fink and Henry N Muller Jr are made assistants to vice-president in charge of engineering. In addition to his engineering duties, Muller will continue to direct the educational dept. In the firm's atomic power div, Bernard F Langer is named manager of structural and heat engineering, and Erling Frisch becomes manager of control engineering. Manufacturing and repair div's new manager is W C Rowland. Also, A M Fisher succeeds W J Maythem Jr as industrial manager of Milwaukee office, and is replaced by J A Holden as manager. Maythem will take up other duties within the company.

**Modine Mfg Co** announces new sales representatives as follows: T R McGovern, 5720 Wilshire Blvd, Los Angeles, Calif., handles Los Angeles territory. J R Dowdell & Co covers Dallas, Texas area with offices at 4024 Swiss Ave, Dallas. In Johannes-


# SIER-BATH ROTARY PUMPS *have no time for down-time*



**SIER-BATH GEAREX PUMP**

*Balanced axial thrust . . . pulseless flow . . . vibrationless operation . . . roller bushings for precision running under load.*

*Pumps:* oils, varnishes, solvents, molasses, chemical solutions.

*Capacities:* 1-550 g.p.m.

*Discharge:* 250 psi for medium or high viscosities. 50 psi for water.

*For higher pressures and capacities use* SIER-BATH SCREW PUMPS.

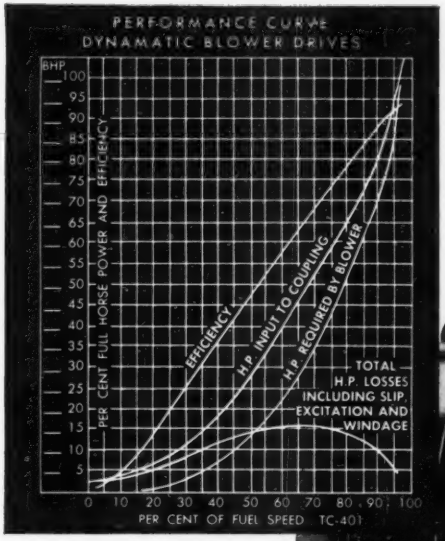
A notable feature of Sier-Bath Rotary Pumps is their relative freedom from down-time for repairs and maintenance. Built in a shop equipped for manufacture of the finest precision gears, Sier-Bath Pumps show surprising ability to stand up under the most rugged operating conditions. The value of such sturdy construction cannot be over-emphasized in these days of high operating costs.

ALSO MAKERS OF SIER-BATH PRECISION GEARS

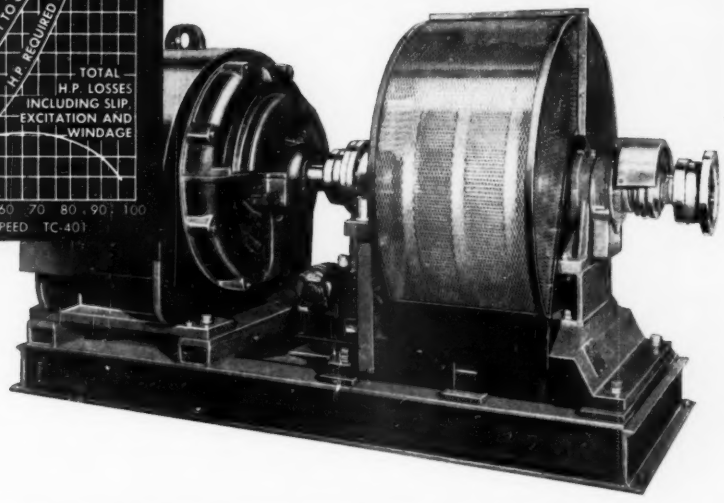
FOUNDED 1905 MEMBER A.G.M.A.

Sier-Bath
GEAR and PUMP CO., Inc.

9254 HUDSON BLVD., NORTH BERGEN, N J




# EATON DYNAMATIC BLOWER DRIVES



## Instantaneous Response to Speed Control

Dynamatic Variable Speed Couplings are ideally adapted to such applications as regulating air drafts in steam generating stations, power house fan drives, public utility induced draft fans, and forced draft fans. Controls can be made to change the output speed of the coupling and hold that speed constant. Response is instantaneous and load changes are closely followed. The speed range available is practically infinite, and can be controlled precisely from ten per cent speed up to full speed.

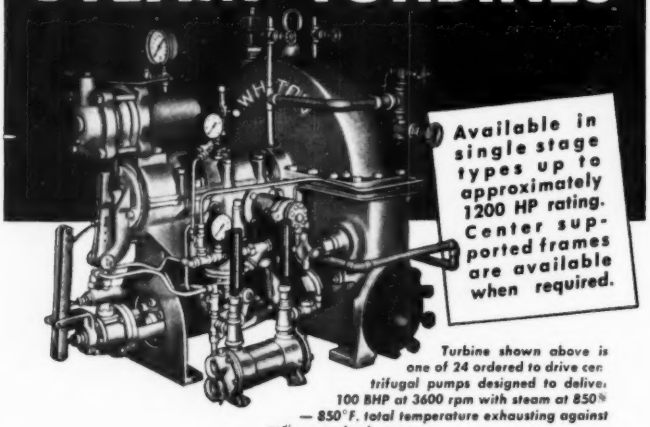
The performance curve above indicates the characteristics of Dynamatic couplings when driving fans or blowers. Fundamentally, all fans and blowers will have curves very close to the ideal curves shown in this figure. Note the desirable relationship between efficiency, horsepower input, and required horsepower. The horsepower losses indicated are normal for this type of application. Both air cooled and water cooled types of Dynamatic couplings are available, selection depending upon loads and type of service involved. The electric-slip coupling was developed and introduced by Dynamatic; this company has pioneered the use of electric-slip couplings in fan and blower drive applications. Write for illustrated literature.

**EATON MANUFACTURING COMPANY • CLEVELAND, OHIO**
**ADDRESS INQUIRIES TO: DYNAMATIC DIVISION • KENOSHA, WISCONSIN**

**PRODUCTS:** SODIUM COOLED, POPPET, AND FREE VALVES • TAPPETS • HYDRAULIC VALVE LIFTERS • VALVE SEAT INSERTS • ROTOR PUMPS • MOTOR TRUCK AXLES • PERMANENT MOLD GRAY IRON CASTINGS • HEATER-DEFROSTER UNITS • SNAP RINGS • SPRINGTITES SPRING WASHERS • COLD DRAWN STEEL • STAMPINGS • LEAF AND COIL SPRINGS • DYNAMATIC DRIVES, BRAKES, DYNAMOMETERS

Whiton SOLID STEEL ROTOR

# STEAM TURBINES



Available in single stage types up to approximately 1200 HP rating. Center supported frames are available when required.

*Turbine shown above is one of 24 ordered to drive centrifugal pumps designed to deliver 100 BHP at 3600 rpm with steam at 850# — 850°F. total temperature exhausting against 42# gauge back pressure.*

## • SIMPLE DESIGN FOR ACCESSIBILITY

Inlet and exhaust connections are located in lower half of casing which is horizontally split to allow easy access to all internal parts. Rotating unit including bearings and governor head may be removed without disturbing alignment of the unit.

## • RUGGED CONSTRUCTION FOR RELIABILITY

Whiton rotors are made from a solid steel forging with semi-circular buckets milled in the rim to give strength where it is needed. End thrust is minimized because the path of the steam is always at right angles to the shaft.

## • SAFETY DEVICES FOR TROUBLE-FREE OPERATION

Standard equipment includes Constant Speed Governor with V-Ported Governor Valve . . . Emergency Governor with Independent Valve . . . Steel Plate Steam Strainer . . . Two oil rings per bearing supplemented by water cooling . . . Sentinel Type Casing Relief Valve . . . Additional accessories available as required.

**THOUSANDS OF SATISFACTORY INSTALLATIONS SINCE 1911**

*Write for complete information*

Whiton 1836

WHITON MACHINE COMPANY

NEW LONDON, CONN., U.S.A.

*also makers of Fine Lathe Chucks • Gear Cutting Machines • High Production Milling Machines • Centering Machines*


burg, South Africa, Safex Engrg Co (Pty) Ltd, New Commercial Exchange Bldg, 3 Harrison St, South, will represent Modine in the Union of South Africa and the Rhodesias.

Charles D McIntire is named industrial sales manager of the Cincinnati branch office of Brown Instruments div, **Minneapolis-Honeywell Regulator Co.** McIntire succeeds George Brown, who will supervise Belfield Valve div sales in Central States region out of headquarters in Cleveland. In addition, Brown Instruments elects John E MacConville industrial sales manager of its Atlanta branch office. He will also handle sales activities out of the firm's Birmingham, Jacksonville and Knoxville offices. William C Waltman is in charge of industrial sales from South Bend office. George Gilliam is now supervising all pyrometer-supply sales for the company.

**Fairbanks, Morse & Co** has appointed T E Woodruff assistant manager of pump sales div, with headquarters in Chicago.

Gerald F Twist takes over duties of Francis F Fairman Jr as manager of Peerless Pump Div, **Food Machy & Chemical Corp,** with offices in Los Angeles.

**General Electric Co** names F Penn Holter manager of manufacturing, Construction Materials Dept, Bridgeport, Conn., succeeding E J Harrington who is assigned to staff of vice-president in charge of manufacturing policy. In transformer and allied product divs at Pittsfield, Mass., Dr Karl B McEachron becomes manager of engineering replacing Frederick F Brand, retired. Harry F McRell is now assistant to the manager of latter divisions. Francis E Fairman Jr and William S Ginn are made manager and assistant manager of sales, respectively. Clement E Sutton Jr is manager of power transformer sales division. In Richland, Wash., J R Kelly becomes acting manager of design division, succeeding F W Wilson, resigned.

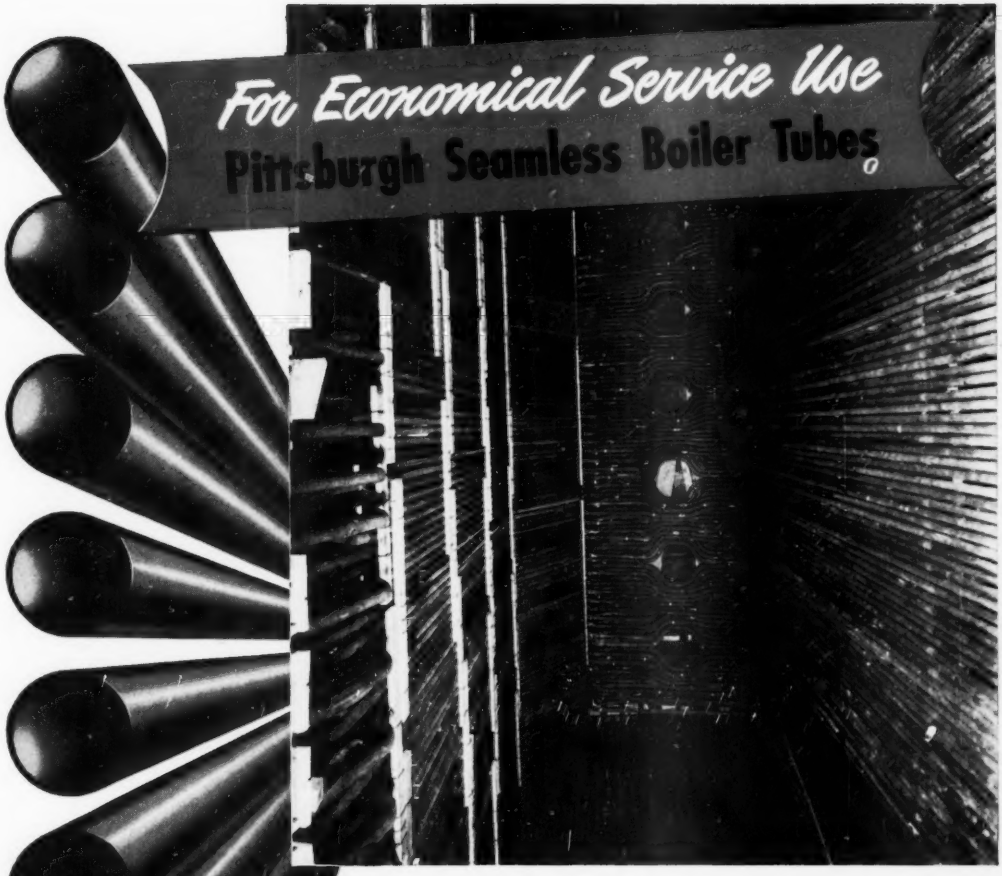
C H Leet has been chosen by **Electric Storage Battery Co** as manager of its Exide Pittsburgh branch.

**Allis-Chalmers,** Milwaukee, Wis., transfers John Gammell from Philadelphia to Milwaukee as supervisor of sales training.

Darwin E Hachat is promoted to superintendent of power at Indiana Harbor, Ind. plant of **Youngstown Sheet & Tube Co.** Floyd Hoskinson joins the company as superintendent of cold drawn-bar dept at Brier Hill, Ohio plant. He replaces J G O'Malley. Edward S Steigner will be associated with Karl L Fetters as tubular products development engineer with offices in the Campbell Works Office Bldg, Youngstown, Ohio.

**Sylvania Electric Products Inc,** New York, N. Y., names Charles H Goddard manager of utility sales and Stuart Goodwillie manager of business relations dept.

**American Chain & Cable Co** has appointed S J Woodworth to succeed A R Haskins as sales manager of its Wright



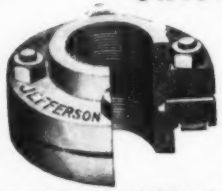

**For long economical service at high pressures and high temperatures specify Pittsburgh Steel Seamless carbon and alloy boiler tubes. They have the ductility and size accuracy to give you ease of installation—the closely controlled chemistry and tensile strength to give long service. Pittsburgh Boiler Tubes are supplied with plain ends or swaged, expanded or upset. Write for complete information on how you can get economical service with Pittsburgh Seamless Boiler Tubes.**

**Pittsburgh Steel Company**

GRANT BUILDING • PITTSBURGH 30, PA.

Jefferson

FLANGE UNIONS




**Save Time and Effort in Making Up**

These unions provide the means of handling large and high pressure piping requirements. They are designed around the basic construction of all Jefferson Unions in that they feature the Recessed Brass Seat. They are made in 2-part and 3-part designs for test pressures up to 6,000 lbs.

Time and effort are saved in making up Jefferson Unions by the ease with which drop-tight joints can be made. The reasons for this advantage are that seating surfaces are true ball joints, and the way the seating ring is secured in a channel in the fitting.

Your nearest distributor can supply you . . . or get in touch with us direct.

**JEFFERSON UNION CO.**

605 W. 26th St., New York 1, N. Y.

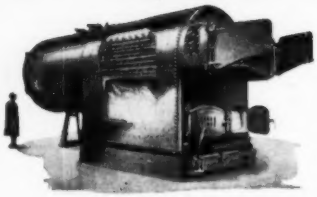
63 Gooding St., Lockport, N. Y.

39 Fletcher Ave., Lexington 73, Mass.



KEWANEE®

HEAVY-DUTY



**10 to 304 hp**

**100, 125 and 150 lbs wp**

Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

*WRITE Department 96-K11 for 6" scale with pipe diameter markings*

KEWANEE BOILER CORPORATION

KEWANEE, ILLINOIS

Division of American Radiator & Standard Sanitary corporation



*Simplify Your Coal Control*

**WITH BEAUMONT Coal Handling Equipment**

● You, like the manufacturer shown, can simplify your coal handling, reduce costs and save space by installing a *Beaumont* Coal Handling System.

One man *at one point* controls the System.

The coal arrives by rail, is dumped into hoppers, conveyed by Beaumont Belt Conveyors and discharged either into a bunker for immediate use or down a chute to storage. In the yard, the coal is spread into compact layers—eliminating air pockets and minimizing the hazard of spontaneous combustion.

Tailblocks maneuver the Beaumont Drag Scraper which is operated through remote control. By means of backhaul towers, the coal can be stored to heights of over 100 feet. Beaumont supplies and installs the complete conveying and storage systems—in capacities from 10 to 300 tons per hour.

If you have a coal-handling problem, contact us. Our engineers will be glad to assist you.

**BEAUMONT BIRCH *Company***

1502 RACE STREET ● PHILADELPHIA 2, PA.

*Designers Manufacturers Erectors*

COAL AND ASH HANDLING SYSTEMS


Hoist Div. His headquarters will be in York, Pa. Haskins resigned to establish a business in Milwaukee, Wis.

Dudley K Bailey, until recently a member of the sales engineering staff of **Weston Electrical Instrument Corp,** joins sales staff of Beedle Equipment Co, Cincinnati. Beedle is Cincinnati district representative for Weston products.

R J Caccavelli is now manager of **Superior Electric Co's** Chicago sales office. Until permanent quarters are established in downtown Chicago, Caccavelli will operate through P O Box 48, Oak Park, Ill.

**SKF Industries Inc,** Philadelphia, elects Emerson D Ogle head of industrial sales dept. He succeeds C D Cummins, who resigned.

F A Leach will handle promotion of various new products for **Reliable Electric Co,** Chicago.

**Protective Coatings Div,** Pittsburgh Coke & Chemical Co announces opening of an office at 711 Thompson Bldg, Tulsa, Okla., to serve the Central Midwest. Frank E McNulty is manager. Benjamin H Means assumes position of service manager for this division throughout entire United States.

Wm E Madden has been made general sales manager of **George Haiss Mfg Co Inc,** New York, division of Pettibone Mulliken Corp, Chicago.

**Pennsylvania Transformer Co,** Pittsburgh, announces following elections: Samuel Horelick, chairman of the board; W E Kerr, president; W R Swoish, vice-president; Samuel Dickson, treasurer; F W Dierker, assistant treasurer.

H J Lilleston, vice-president of **Paraffine Companies Inc,** has returned to San Francisco. In his new position, Lilleston will supervise and coordinate marketing, advertising and merchandising of all Pabco products sold in the firm's domestic div.

Chester C McMillan becomes chief sales engineer of the chemical div of **Portland Shingle Co,** Portland, Ore.

**I. O Koven & Brother Inc,** Jersey City, N. J., reports that Kenneth H MacWatt is now director of engineering sales. He succeeds W D Birch, resigned.

W M Griffith has been named district manager of the southern area, Pacific Coast territory, of Superior Engine div, **National Supply Co.** Griffith's headquarters will be at Torrance, Calif., plant.

**Kieley & Mueller Inc** selects the following as its sales representatives: W J Beckett Co, 108 W 6th St, Los Angeles, will cover all of California south of, and including Inyo, Fresno, San Benito and Monterey counties, and all of Arizona. Hugh Rodman, 270 Fremont St, San Francisco, handles area north of and including California counties of Mono, Madera, Merced, Santa Clara, Santa Cruz, and the Mineral,

# Clinchfield

## The Choice of Those Demanding The Utmost in

# BITUMINOUS COALS

13 feet thick . . . an actual photograph at Clinchfield's Clintwood-Seam Coal.

**DANTE** **STOKER COAL**

produced from the famous Banner seam in the Southern Appalachian Field is low in ash, the fusion is right and it has ideal burning characteristics. Washed, mechanically prepared and oil treated. "Dante" gives perfect stoker performance.

CLINCHFIELD is a name that has been identified with high quality coal for many years . . . a quality that begins right in the coal measures and is further developed in new preparation plants with the most modern washing and cleaning equipment. Specify Clinchfield coal on your next order . . . it insures better performance and greater economy . . . two important factors for large and small users alike.

## *New MOSS and New MEADE Clintwood Seam Coals are adaptable for your every need*

COAL CLINCHFIELD SERVICE

Modern preparation in new multi-million-dollar plants assures perfect uniform sizing. These well known coals are also low in sulphur, ash and moisture content. They have a high heat value; ignite readily and give quick heat. Egg, Stove, Nut and smaller sizes are cleaned by the Chance Flotation Process and are oil treated if desired.

***CLINCHFIELD COALS** are distributed by these Pittston Company Coal Distributing Subsidiaries*

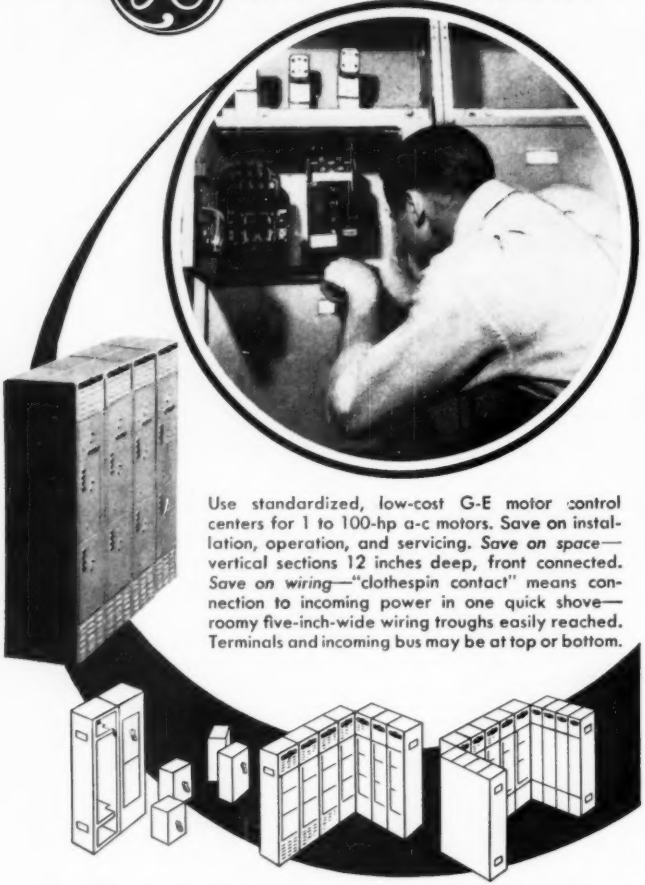
**CLINCHFIELD FUEL COMPANY**
SPARTANBURG, SOUTH CAROLINA

**GLOBE COAL COMPANY**
CHICAGO, ILLINOIS

**RALEIGH SMOKELESS FUEL CO.**
NORFOLK, VIRGINIA

# MODERNIZATION *made easy*

... Motor Control Centers



Use standardized, low-cost G-E motor control centers for 1 to 100-hp a-c motors. Save on installation, operation, and servicing. *Save on space*—vertical sections 12 inches deep, front connected. *Save on wiring*—"clothespin contact" means connection to incoming power in one quick shove—roomy five-inch-wide wiring troughs easily reached. Terminals and incoming bus may be at top or bottom.



*Protection to equipment and personnel assured.* Each unit (NEMA Size 1, 2, 3, and 4 for 440 volts or below) is completely metal enclosed, has short-circuit and overload protection built in. Standard parts mean few spare parts to store, speed servicing. Locate all your control in one place, wherever space and operating conditions demand it. You'll like the easy way to modernize with G-E motor control centers. Write for Bulletin GEA-4979 for more details on this low-cost equipment. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC


Lyon, Douglas, Ormsby, Storey and Washoe counties in Nevada. Farnes & Martig Inc, 417 N E Couch St, Portland, will cover states of Oregon and Washington, and west of the eastern boundaries of Idaho counties of Clearwater, Boise, Bonner, Idaho, Elmore, Shoshone, Valley and Owyhee.

Hamilton Corey replaces Y P King, retired, as branch manager for **Graybar Electric Co** at Charlotte, N. C.

Charles Graff succeeds John L York, who died recently, as advertising manager of **Clark Bros Co,** Olean, N. Y.

**Hammel-Dahl Co** appoints Horace A Thompson Jr as dealer for its equipment. Thompson Engrg Co will handle territory in central and eastern Louisiana, southern Mississippi and northwestern Florida.

David Neill is now Cincinnati sales representative for **Farrel-Brimingham's** line of gears, gear units and flexible couplings.

**Electric Products Co,** Cleveland, Ohio, appoints E G Schroeder field sales manager. In his new position Schroeder will supervise all district sales activities.

A H Loux is promoted to manager of distributor sales for **Flexible Tubing Co,** Branford, Conn.

**Flexitallic Gasket Co,** Camden, N. J. has chosen following distributors as its representatives: Power Engrg & Equipment Co Inc, 131 N Marine Ave, Wilmington, Calif., will serve southern California including San Luis Obispo, Kern and San Bernardino counties. Northern California will be covered by Transmission Engrg Co, 53 Stevenson St, San Francisco. Tube Engrg & Service Co, Ltd, 2052 St. Catherine St, W, Montreal will handle all Canadian provinces east of Manitoba.

**Clapp Instrument Co,** Webster, Mass., elects Arthur S Brown president of the firm. T W Lanman and Charles Clift are made vice-president and treasurer, respectively.

A sales office has been established at 819 S 39th St, Louisville Ky., as a branch of **Cutler-Hammer's** Cincinnati district office. It will be under direction of E C Bolton with W J Phillips as manager. Louisville territory includes most of Kentucky and a part of Indiana.

**Eclipse-Pioneer Div,** Bendix Aviation Corp, selects Holden Co Ltd, Montreal, as its Canadian sales agents for Eclipse seamless flexible metal hose.

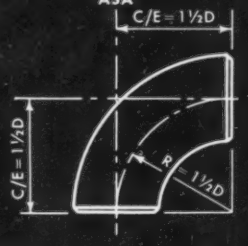
E J Cremer is now manager of **Binks Mfg Co's** new sales and engineering office in Empire State Bldg, New York, N. Y.

**Chain Belt Co** reports several changes in personnel as follows: In the chain and transmission div William J Sparling is elected vice-president and manager. E P Meyer succeeds Sparling as works manager. Roscoe O Byers becomes factory manager. Clarence B Ringham is made

# Improvements and economies in welded piping result from this *Variety* of MIDWEST ELBOWS

**1**

**LONG RADIUS ASA**

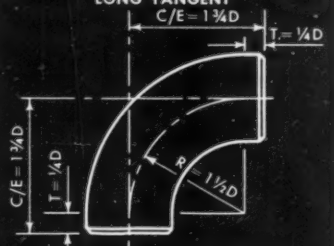



**SIZES: ¾" TO 24", INCLUSIVE**

Dimensions conform to applicable size range of American Standard for Butt-Welding Fittings, ASA B16.9. Radius and center-to-end dimension equal 1½ times nominal pipe size.

**2**

**LONG RADIUS LONG TANGENT**

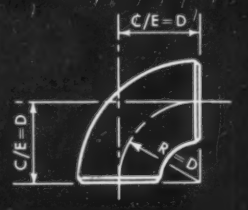



**SIZES: 2" TO 20", INCLUSIVE**

Same radius as ASA Elbows but with long integral tangent on each end—an exclusive Midwest feature that saves time and pipe. No price increase over ASA Elbows.

**3**

**SHORT RADIUS**

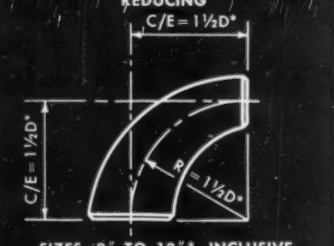



**SIZES: 1" TO 30", INCLUSIVE**

Where space limitations prevent use of ASA Elbows or Midwest "Long Tangent" Elbows shown above at right, these short turn elbows without tangents are recommended.

**4**

**LONG RADIUS REDUCING**




**SIZES: 2" TO 12"*, INCLUSIVE**

Midwest Reducing Elbow takes the place of a straight elbow and a reducer. It saves more than one-third of the welding and improves both design and appearance.

**SYMBOLS** { *C/E—Center-to-End Dimension* *T—Length of Tangent* *D—Nominal Pipe Size* *R—Radius* **D—Dimension is for larger Pipe Size*

## MIDWEST WELDING FITTINGS Improve Piping Designs and Reduce Costs

90° ELBOWS

REDUCING 90° ELBOWS

45° ELBOWS

LAP-JOINT STUB ENDS

REDUCERS

CAPS

SADDLES

SLEEVES

RETURN BENDS

TEES

LATERALS

CROSSES

REDUCING-ON-RUN TEES

SHAPED NIPPLES

FLANGES

The *variety* of Midwest Welding Elbows is particularly important because of the exceptional latitude in design and economy in erection that it provides. For example, the Midwest Long Tangent Elbow permits faster, easier, more accurate lining up with pipe . . . removes weld from point of maximum bending stress . . . often eliminates a short nipple and its extra weld. Slip-on flanges are easily used with minimum change in flange and fitting.

This "Variety" is only one of several reasons why many users prefer Midwest Welding Elbows.

**Only MIDWEST offers this VARIETY**

**MIDWEST PIPING & SUPPLY CO., Inc.**

Main Offices: 1450 South Second Street, St. Louis (4), Mo.

*Sales Offices:* New York (7), 30 Church St.

Chicago (3), 79 West Monroe St. • Los Angeles (33), 520 Anderson St. • Houston (2), 229 Shell Bldg. • Tulsa (2), 533 Maya Bldg. South Boston (27), 426 First St. • Distributors in Principal Cities.

# "GUNITE" Concrete

(SINCE 1915)

*Linings for*

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
UPTAKES •
BREECHINGS •
• • •
STEEL & PIPE ENCASEMENT
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FIREPROOFING •

**GUNITE CONCRETE & CONST. CO.**

1301 Woodswether Road
KANSAS CITY 6, MO.

R. N. Turner, Dist. Mgr., 228 No. La Salle St., Chicago 1, Ill. B. H. Mueller, Distr. Mgr., 6625 Delmar Blvd., University City, (St. Louis), Mo. Philip D. Barnard, Distr. Mgr., 2036 Addison, Houston 5, Tex.

Branch Offices: New Orleans, Dallas, Denver.

*"See our catalog in Sweet's"*



# GHD TRANSFORMERS

**STANDARD & SPECIAL**

From ¼ to 400 KVA
up to 15,000 volts
We manufacture a complete line of:

***AIR, OIL OR WATER-COOLED DISTRIBUTION TRANSFORMERS**

**Special Designs available to meet Customers' Specific Requirements.*

TRANSFORMERS FOR
* ELECTRIC FURNACES
* WELDING
* HEATING
* PHASE CHANGING
Etc.

POWER & LIGHT TRANSFORMERS

For isolation of Light from Power, or Light from Telephone

EISLER TRANSFORMERS are *manufactured strictly to Standards of the N.E.M.A., A.S.A., and A.I.E.E.*

WRITE FOR SPECIAL CATALOG

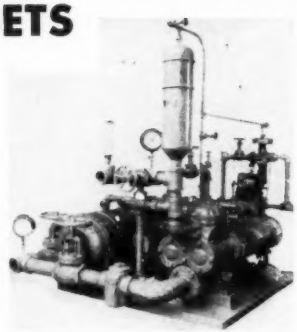
**EISLER** ENGINEERING CO., INC.
Chas. Eisler, Pres.
757 South 13th Street, Newark 3, N. J.

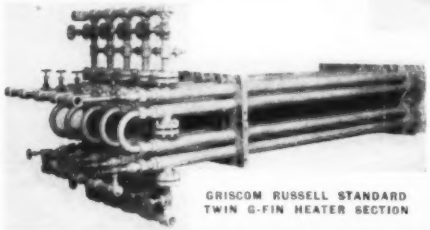


# LOCKETT FUEL OIL PUMPING and HEATING SETS

## *Custom Built*

For almost a half century, Lockett has been supplying, to fit individual needs, efficient, standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available. Each pump is suitable for the full rated capacity of the unit; and one heater section is a spare. Lockett supplies everything, complete. Inquiries are invited. *Ask for Bulletin AML 40-2.*





GRISCOM RUSSELL STANDARD TWIN G-FIN HEATER SECTION

The efficient, compact unit illustrated above, consists of one Worthington Duplex Steam Pump and one Electric-driven Pump.

Heaters for Lockett Pumping and Heating Sets consist of the proper number of G-Fin Sections mounted in parallel, or series, with one unit as a spare. *Ask for Bulletin AML-40-4.*

**A. M. LOCKETT & COMPANY, LTD.**
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON


factory manager, heavy machinery div, and George B Flanigan assumes duties of manager, trade relations.

James R Coe has been named chief traveling engineer for **Brooks Boiler Treatment Co.** He will be in charge of Eastern div office in New York City.

**Anaconda Wire & Cable Co,** New York, N. Y., promotes E F Luna to sales promotion manager of the company.

Stanley E Cobbledick is appointed sales manager of Franklin Steel Div of **Borg-Warner Corp,** Franklin, Pa. Samuel W Cherry becomes superintendent of the plant.

**American Wheelabrator & Equip Corp** opens a sales office in Salt Lake City. T Max Stanger will be in charge.

Joseph H Parsons and Robert B Pogue have been named vice-presidents and Rosser L Wilson has been promoted to chief engineer of Brake Shoe & Castings Div, **American Brake Shoe Co.**

Sample Brothers, St. Louis, Mo., is now handling sales of **Burgess-Manning** silencing equipment in the St. Louis territory.

**Enterprise Engine & Foundry Co,** San Francisco, appoints John H Sheusner chief engineer.

**Cornish Wire Co Inc,** New York City, has chosen Alexander Norden Jr to organize a new division, wired assemblies div, for designing, engineering and manufacturing of staple and specialized electrical wire assemblies for manufacturers of power equipment.

C Victor Mars becomes manager of **Ansul Chemical Co's** new product dept. Robert J Yaeger succeeds Mars as sales manager of industrial chemical div.

O G Hittle has resigned as manager of the Lower Columbia District, **Bonneville Power Administration,** with headquarters at Vancouver, Wash. Charles E Dunn, district engineer, will serve as acting manager until a permanent appointment is made.

**Narragansett Electric Co,** Providence, R. I., reports following promotions: Ernest F Walsh is now superintendent of power plants; Harold G Morse, assistant superintendent of production; and Albert J Wells, assistant to superintendent of power plants.

Matt L McWhorter replaces Walter R McDonald as chairman of **Georgia Public Service Commission.** Perry Knight succeeds McWhorter as vice-chairman.

Stephen M Batori, formerly associated with DeWitt C Griffin & Associates, announces formation of **Stephen Batori & Co,** engineers and consultants, with offices at 200 James St, Seattle, Wash.

Armour Research Foundation and Graduate School of **Illinois Institute of Technology** have added to their staffs Wilhelm

# There are NO HALF-WAY solutions

*to water conditioning problems*

# when ELGIN does the solving!

Today the science of water conditioning has reached the point where there is absolutely no excuse for any plant accepting anything short of a COMPLETE solution to ANY water conditioning problem!

Yet despite this, it is amazing to see how many operating men are still resigned to the old order of fighting water — resigned to the half-way correction of their troubles.

Their predicament is not so amazing when you examine it more closely. Very obviously it is the result of someone attempting to fit the plant's water conditions to a method instead of choosing the method that exactly fits the condition . . . as Elgin does.

Because Elgin has available all authoritative methods of water conditioning* there are no half-way or "almost" solutions where Elgin has been called upon to do the job.

Working with all methods assures the direct, common-sense, low cost approach. It may be extremely simple as in a small plant where the problem was merely to step up softened water output. The Elgin recommendation was simply to remodel an existing zeolite softener by equipping it with Elgin "Double-Check" Manifolds and adding zeolite. The whole job cost $201.00. Soft water output was stepped up 44% per regeneration. The $201.00 bought the plant the equivalent of a $1205.00 Elgin "Double-Check" Softener!

This was the complete solution of a simple problem, but in another plant complete solution involved filtration, taste and odor correction, sludge removal, chemical treatment, post treatment and other Elgin methods. This problem was complicated, but Elgin, with all methods available, did the job completely and at a worthwhile saving.

Whether your problem is simple or complex it is *safer* in the hands of the firm that has the knowledge and the methods to solve *all the way!* Let us show you what we can do for you.

**ELGIN SOFTENER CORPORATION, 130 N. Grove Ave., Elgin, Illinois**

## UP TO 44% MORE SOFT WATER from the same size softener using same type zeolite . . .

That's the story of the Elgin "Double-Check" Zeolite Softener, an outstanding example of Elgin accomplishment. The "Double-Check" manifold design prevents escape of zeolite; therefore permits using more zeolite in a tank of given size. Better and more thorough backwashing means higher efficiency. The over-all result is more soft water at less cost. As explained above, the "Double-Check" equipment can also be installed in existing softeners of any make with remarkable results.

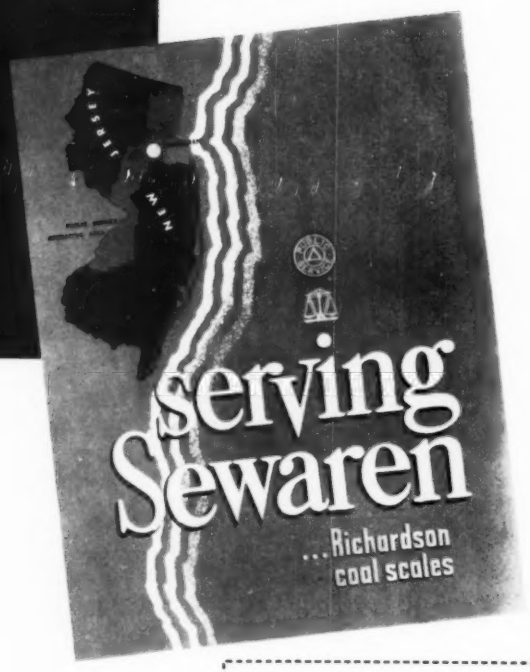
* Elgin methods and products include: water softeners, boiler feed water treatments, post treatments for softened water, corrosion inhibitors, sludge removal systems, filters and purifiers, iron removal equipment, chemical feeders, water testing equipment, zeolite of all types.

**SERVING SEWAREN illustrates the installation of Richardson Coal Scales in the new 450,000 kw. Sewaren Steam Generating Station, of Public Service Electric and Gas Company, New Jersey.**

**Twelve self-testing, 400 lb., elongated Automatic Coal Scales meet Sewaren's requirements for efficient, economical recording of all coal consumed. These scales are self-testing . . . accuracy indicating . . . dust tight for cleanliness . . . equipped with motorized by-pass gates . . . elongated for maximum bunker discharge.**

**You'll be especially interested in the complete cross section of the boiler house and turbine room at Sewaren—the first station to use steam at 1050°F. commercially.**

**Serving Sewaren is a specific example of Richardson's ability to help central stations and industrials eliminate coal waste and *produce more power at less cost.* For your FREE copy of this attractive three-color folder, fill out the coupon below.**

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Please send me a copy of your new folder *Serving Sewaren.*
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Spannhake as senior research scientist in the applied mechanics research dept of the Foundation and adjunct professor in the school of mechanics of the College.

## OBITUARIES

**John L York,** 62, advertising manager, Clark Bros Co, Olean, N. Y., died recently after an extended illness.

**Dr Arthur L Jacoby,** 39, associate director of research, National Aluminate Corp, Chicago, died Aug 13 from a heart attack.

**Elmer J Young,** 66, chief engineer for the Board of Education, Niagara Falls, N. Y., died Sept 12 from a heart attack.

**Edwin D Winchell,** stationary engineer at Memorial Hospital, Syracuse, N. Y., died Sept 1.

---

**Plans are being formulated** in Chattanooga, Tenn., to reactivate the $68,000,000 Volunteer Ordnance Works at Tyner and convert it into production of synthetic fuels from coal. Blaine Buchannan, attorney for some 200 coal mines and coal land owners, said that Senators Kenneth McKeller and Estes Kefauver have announced their support of the plan. The plant was constructed for the making of explosives during the war but has been idle since hostilities ceased. Investigations are being conducted with a view to turning the plant into a 10,000 barrel-a-day plant to use about 6000 tons of coal per day.

**E N Gosselin,** president of Graver Tank & Mfg Co, has announced establishment of Graver Water Conditioning Co as a division of the company to extend the operations that have been conducted by the Graver water conditioning and process equipment dept.

**International Standardization Organization** made a favorable start toward unification of the various national standards on screw threads at its recent 3-day meeting in Paris, it was disclosed in a report released by American Society of Mechanical Engineers. Delegates from 15 of the 18 countries represented voted to recommend the recently established *Unified Anglo-American Screw Thread* to their national standardizing bodies as the common profile for the metric and inch systems of screw threads.

**Dr Max Schiesser,** head of Brown Boveri Co, at Baden, Switzerland, and president of Swiss Electrotechnical Institution since 1939, has been elected president of International Electrotechnical Commission. As president of the IEC, he heads the international organization that has been responsible for correlating opinion on electrical problems in 25 member countries and is credited with bringing about a large degree of standardization and interchangeability in electrical products throughout the world. The IEC is now the electrical section of the International Organization for Standardization.

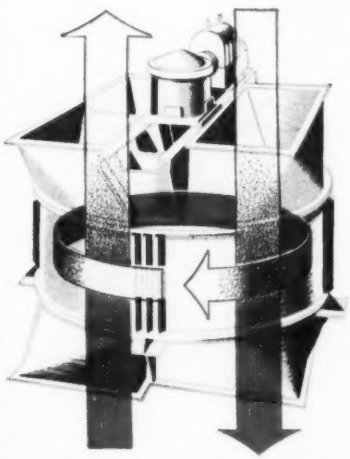
# Fact File on Preheat

## No. 5

In the Ljungstrom air preheater the compact arrangement of rotating heat transfer elements assures maximum heat recovery for its size and weight.

The higher recovery possible with the regenerative feature more than compensates for the small amounts of air that pass to the gas side of the heater by entrainment in the moving rotor and at the seals. This passage of air is predictable and consistent during the life of the plant with allowance being readily made in the initial selection of the preheater and fans.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gas-to-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of leading power plants and other special applications confirm its high level of heat recovery and long-term low maintenance service.

THE

**AIR PREHEATER CORPORATION**

**60 EAST 42ND STREET · NEW YORK 17, N. Y.**

**Plant: Wellsville, N. Y.** 2410

"Our best ads are installed . . ."

Multi-Fin air cooled unit

COOLING TOWERS
WOOD TANKS
STAINLESS TANKS
WOOD PIPE
since 1903 MULTI-FIN UNITS

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HOW TO MEASURE INSULATION RESISTANCE

To obtain a proper megohm reading of insulation resistance, it is necessary to provide a constant high voltage DC potential which will produce sufficient current flow through the resistor under test to actuate a means of indication.

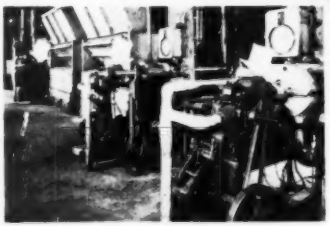
VIBROTEST
Model 201
Range 0-200 Megohms at 500v potential. 150-300-600 volts AC or DC.)

VIBROTEST'S EFFORTLESS *Battery-operated* power supply is the *only positive*, "push-button" means of obtaining *constant* high voltage for accurate insulation resistance measurement. Tiresome, inaccurate CRANKING ELIMINATED; NO LEVELLING; NO ERRONEOUS READINGS due to surface leakage; NO SHOCK when disconnecting; EASY SCALE READING in ohms, megohms, AC or DC voltage; ACCURATE in -40° to 140° F. MEASURES resistance values of insulation, windings, armatures; test wiring continuity, connections; checks for shorts, leaks, opens; tests power source voltage, AC or DC—10 models covering entire range of resistance measurement from 100 to 50,000 megohms.

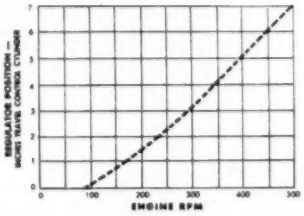
Valuable information on Insulation resistance measurement. Contains handy reference chart showing proper ranges for general laboratory and field testing; for general industrial testing and for Research testing. WRITE for it, or use inquiry card.

GET BULLETIN 209

ASSOCIATED RESEARCH, INCORPORATED
3770 W. Belmont • Chicago 18



Positive, Variable, Precise—Three Troy-Engberg Steam Engines drive stokers in a C B & Q Boiler House. Speed is infinitely variable from 120 to 500 r.p.m. under the precise control of Type EN Governors. With these fully enclosed, self-lubricating ball-bearing governors hand lubrication is a thing of the past.




Straight Line Control—Despite changes in steam pressure and sudden load demands, the Troy-Engberg Type EN Governor produces almost perfect straight line relationship between engine speed and control cylinder travel of the Republic flow meters.

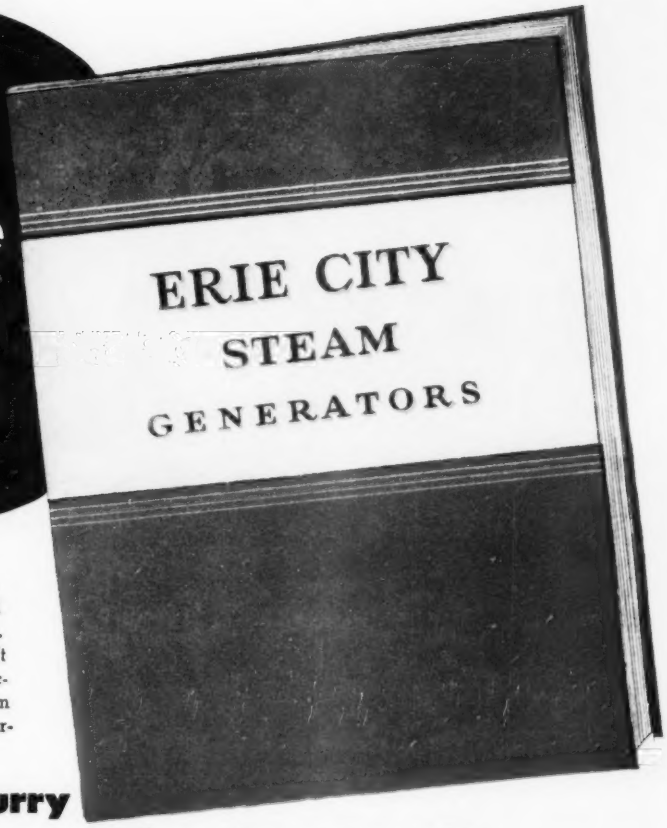
Yes, in the Chicago 14th Street Boiler House of the Chicago, Burlington & Quincy Railroad, Zephyr-smooth steam supply is assured by Troy-Engberg Steam Engines and Type EN Governors, the ideal combination for a chain grate stoker drive. For this exacting service, extremely wide speed range is combined with precise speed control to achieve top boiler performance and utmost economy of operation.

If you are driving stokers . . . pumps . . . fans . . . blowers . . . conveyors . . . or any equipment where the drive must be positive, the speed variable, and the speed range wide — you can count on Troy-Engberg Steam Engines to stand up under the toughest grind. If precise speed control under widely changing load is your problem, the Troy-Engberg Type EN Governor is your solution. And if you are interested in true overall economy, it will pay you to look into the facts of Troy-Engberg By-Product Power.

Troy Engine & Machine Co.
*(Established 1870)*
2500-G Railroad Ave. • Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

# NEW 40 Page Catalog of INTEREST




To Consulting Engineers, Industrial Plants and Central Stations ***with need for 50,000 lbs. of steam per hour or more.*** It describes and illustrates in cross section each unit of the Erie City Steam Generator. Request on company letterhead please.

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## Dial our representative in your city . . . .

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COMPLETE STEAM POWER PLANT EQUIPMENT

**ERIE CITY**

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

**ERIE CITY IRON WORKS • ERIE, PA. •** *Since 1840*

# NEED A *Reciprocating Pump?*

## Let WARREN put a dependable, high performer on the job . . .

**SELECT FROM THESE:**

Horizontal and Vertical single piston
Horizontal and Vertical duplex piston
Single and Duplex Outside Packed Plunger
Single, Duplex and Compound Hydraulic
Steam Heat Vacuum
Automatic Pump and Receiver, etc., etc.

Satisfaction guaranteed . . . by one of the country's largest *exclusive* pumpmakers, by long and specialized application engineering, by craftsmanship from conscientious workmen.

Warren speaks your language. Tell us of your problem and get a good, sound recommendation.

**WARREN CENTRIFUGAL PUMPS**

Single and multi-stage
Pressure range: 0 to 1200 P. S. I.
Capacities: 5 to 50,000 G. P. M.
Types: Horizontal and Vertical
Impellers: Open or enclosed
Casings: Horizontal or Vertical Split, cast iron or bronze
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P-19

**WARREN STEAM PUMP COMPANY, INC.** SERVICE EVERYWHERE **WARREN, MASS.**

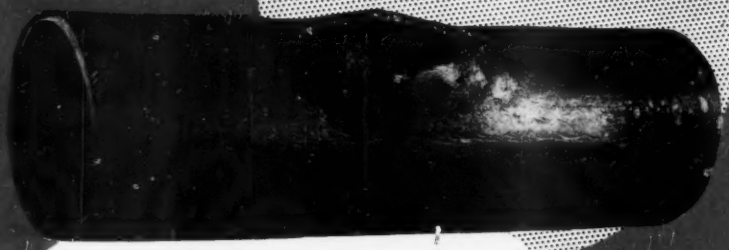
# WARREN PUMPS

CENTRIFUGAL AND RECIPROCATING

*For: Power Plants · · · Chemical Plants · · · Paper Mills · · · Food Industries · · · Metal Working · · · Oil and Mining Services*

# PREVENT BOILER TUBE FAILURES OF THIS TYPE WITH—

## DREW *Organic* SLUDGE CONDITIONERS



Adherent sludge and suspended matter will result in the failure of boiler tubes in the same manner as scale . . . by causing the overheating of tube metal. Generally accepted procedures for the prevention of scale involve proper chemical treatment and control. Sludge is formed in these processes. Drew Organic Sludge Conditioners, used in conjunction with proper chemical treatment, prevent the adherence of sludge and suspended matter to tube metal and eliminate failures of this kind.

*A Drew Engineer will be glad to call on you to discuss sludge and any other water problems which you may have. No obligation.*

POWER DREW CHEMICALS

**E. F. DREW & CO. INC.**
15 E. 26th ST., NEW YORK 10, N. Y.
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268 Market Street San Francisco, Cal.

BOILER WATER TREATMENT
COOLING WATER CONDITIONING

# These coils are designed for continuous operation at

356° F.
Conductor: Copper wire
Conductor insulation: Silicone Mica-Glas Tape
Ground insulation: Silicone Mica-Glas Wrapper
Outside tape: Silicone Fiberglas Tape
Finish: Silicone Varnish Used Exclusively

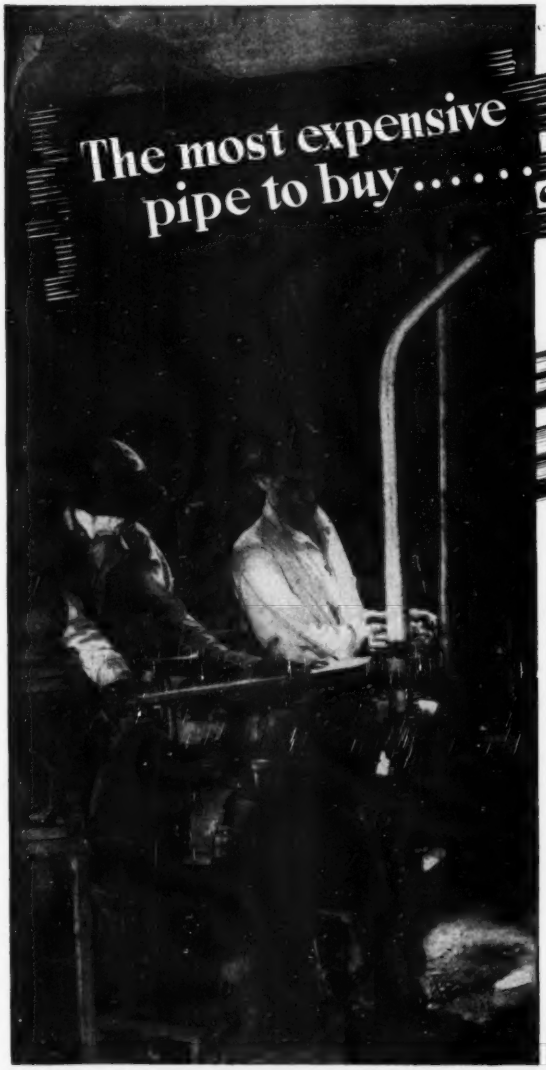
Where standard Class B coils fail with excessive frequency because of high heat, National's special Silicone Mica-Glas coils will reduce the frequency of failure tremendously. They will operate without damage at 356° F., and up to 450° F. under certain conditions. For instance, the life of Class B windings of a motor averaged just 50 days over a four-year period; the same motor in the same work, equipped with National Silicone Mica-Glas windings, has operated for four years without a single failure caused by heat. We can supply such windings for any motor or generator, of foreign or domestic manufacture; they can be installed in our shop or yours, by us or you. If heat-failures cost you money, get in touch with us NOW.

**NATIONAL ELECTRIC COIL COMPANY**

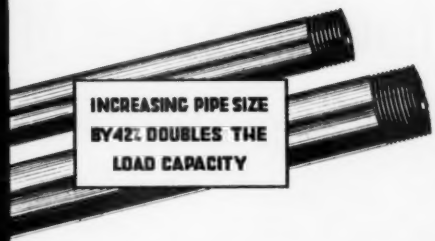
COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS MAKERS OF ELECTRICAL COILS AND INSULATION — DESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

# INSTALL STEEL PIPING ADEQUATE FOR TOMORROW'S NEEDS




"... is the pipe that's *"just big enough"*




THE wise builder buys steel pipe as an investment for tomorrow, as well as for today. He doesn't figure on the smallest size he can "get by" with. He projects water and steam and other production loads as far into the future as he can, and anticipates his pipe requirements accordingly.

Youngstown would rather supply you with adequately sized steel pipe today, than to sell you undersized pipe now and a replacement job later. Youngstown steel pipe is sold by leading distributors in every market.

QUALITY
YOUNGSTOWN
SERVICE
YOUNGSTOWN
THE YOUNGSTOWN SHEET AND TUBE COMPANY
GENERAL OFFICES - YOUNGSTOWN 1, OHIO
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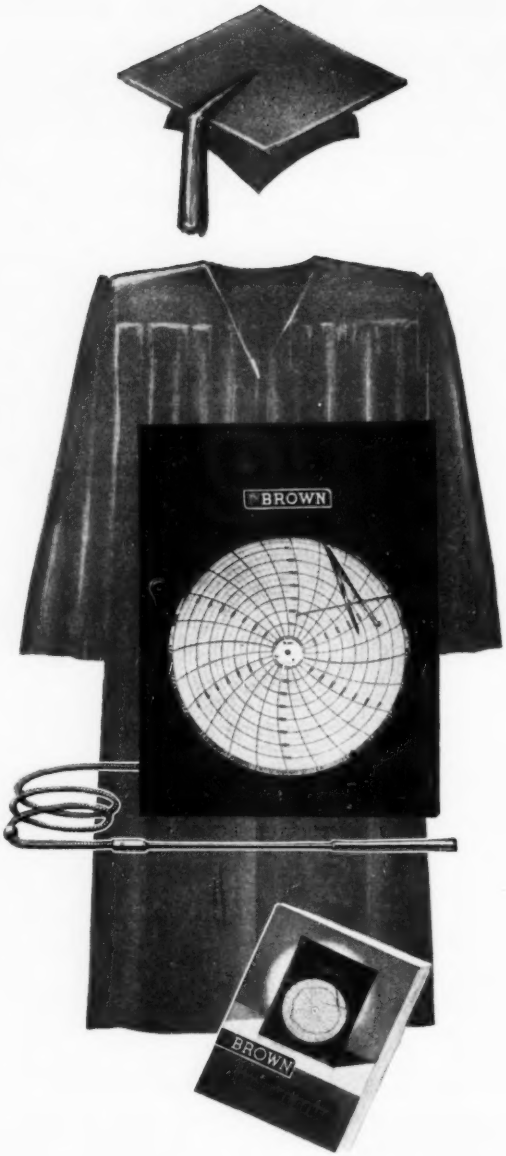
Manufacturers of
CARBON - ALLOY AND YOLOY STEELS
PIPE AND TUBULAR PRODUCTS - SHEETS - PLATES - CONDUIT - BARS - RODS - WIRE - COLD FINISHED
CARBON AND ALLOY BARS - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - TIE PLATES AND SPIKES

# THE THERMOMETER *with Degrees* from the School of Practical Experience




ACTUAL experience, in thousands of plants and operations, has proved that the Brown Thermometer can be relied upon for continuous and satisfactory service. Accurate temperature measurement and control, permanent record, greater power, speedy response . . . these are the popular features which have helped the Brown Thermometer remain first choice with practical production men year after year!

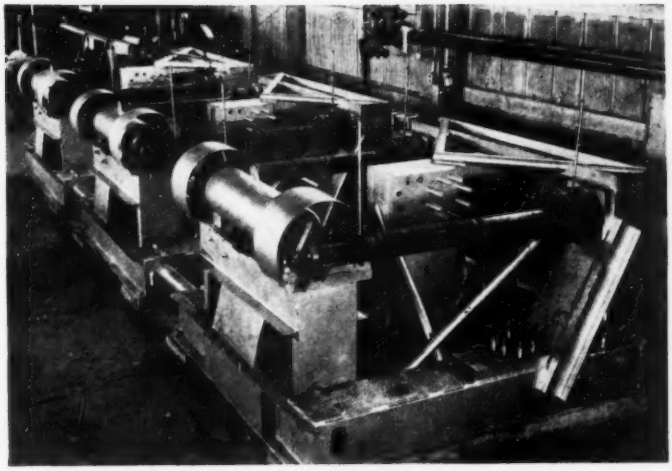
Investigate Brown Thermometers . . . indicating, recording, controlling . . . for *your* temperature problems. Control may be electric or pneumatic . . . in all forms. The bulb may be located at any distance up to 200 feet from the instrument.

It will pay *you* to specify Brown Thermometers . . . proved by practical experience . . . in your plant.

**MINNEAPOLIS-HONEYWELL REGULATOR CO.**
BROWN INSTRUMENTS DIVISION
4490 Wayne Avenue, Philadelphia 44, Pa.
*Offices in principal cities of the United States, Canada and throughout the world*

*Write, today, for your copy of Catalog 6708 . . . for complete information on Brown Thermometers. No obligation.*

MINNEAPOLIS Honeywell *Advanced Instrumentation* FOR BETTER PROCESSING BROWN INSTRUMENTS



## Strength through Design in Tube-Turn welding flanges

# Taking the measure of piping fatigue

PIPE lines are *live, dynamic* members of a piping system. They *breathe* with changes in temperature and pressure. And the danger of fatigue failure from pressure shock, thermal shock, and cyclic conditions is ever-present.

More precise information was needed on this subject. So, Tube Turns research engineers set out to get the answers. For the purpose, they designed and built a unique cyclic testing machine to handle full-size piping assemblies under a wide range of temperature, pressure, and corrosive conditions. And on this torture rack they subjected flanged assemblies to reverse bending tests carried on to ultimate failure. Information revealed forms the basis of new designs for greater strength in Tube-Turn welding flanges.

Other piping assemblies, too—welding elbows, mitre bends, manufactured and fabricated tees, pipe bends—have been subjected to punishment more severe than any they would probably face in normal service.

TUBE-TURN

tt

WELDING FITTINGS AND FLANGES

And this perpetual search for greater strength through better design has paid off in the form of realistic, non-theoretical facts providing a sound basis for Tube Turns' manufacturing policies—facts important to anyone interested in getting his money's worth in long life from piping installations.

Tube Turns' research and development organization, finest in the welding fittings industry, is constantly striving for the improvement of present products, the development of new ones. Notable among their recent achievements have been the design of a new type welding tee and the development of aluminum welding flanges.

Ask to be put on the mailing list for Tube Turns' technical periodical, *Piping Engineering*. Paper 6.01, for instance, deals extensively with standard steel flanges. Others give you research findings and additional working information pertaining to piping not generally available in convenient form.

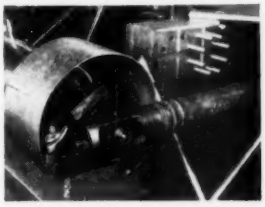
## TUBE TURNS, INC.

**236 East Broadway, Dept. K, Louisville 1, Kentucky**

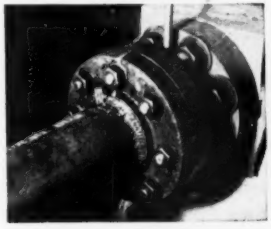
**Dist. Offices: New York, Philadelphia, Pittsburgh, Chicago, Houston, Tulsa, San Francisco, Los Angeles**

## TYPICAL FLANGE ASSEMBLY TESTS

Assemblies were of 4-inch nominal size with 300 pound forged steel flanges and standard weight pipe.



Eccentric crank arm produces up-and-down movement which creates a cyclic bending moment on flange or fitting at opposite end of assembly.



Water spurts from crack in test specimen. Almost invariably, failure occurred in the pipe adjacent to the flange.

Aluminum welding flanges . . . another Tube Turns first! Available in a wide range of types and sizes.

# When you buy a boiler, do you surrender your right to choose the stoker?

If you are considering the purchase of a new boiler, make sure you *retain* the privilege of selecting the Spreader stoker of your own choice. And look *closely* at Spreader stokers! Be certain you get these 4 features: 1. *Clogless feeding* of wet or dry coal; 2. *Even* coal distribution; 3. A cinder return system that works; and 4. *Adjustable* overfire air.

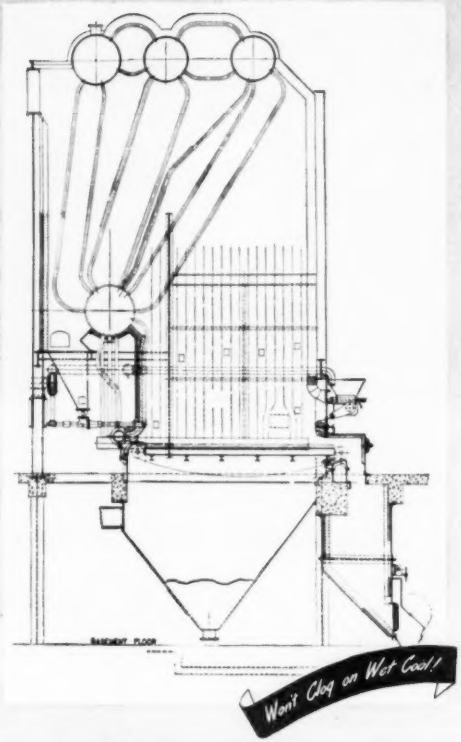
With Æ Perfect Spread Stokers, you are sure of all four—*and more.* The exclusive feeder handles coal at a rate adjustable from 50 to 7500 lbs. per hour; the overthrow impeller was developed—after experience with many designs—to spread the coal evenly. *Individual* cinder returns tap *every* cinder drain point. Each return has its own Venturi air jet to the furnace. And every overfire air nozzle is adjustable.

You can burn less costly lower grade coal efficiently, reliably and with better control of stack discharge.

Besides these 4 big features there are many more that make the Æ Perfect Spread Stoker the standard of comparison for engineering, construction, operation, performance and economy.

No matter who supplies your boiler, *insist* that an Æ Perfect Spread Stoker be installed. Full details are contained in our new illustrated catalog. Send for your free copy today.

**FREE!** *Get this informative catalog on Æ Perfect Spread Stokers now. Write Dept. 10.*




1948 Æ Perfect Spread Stoker installation in the Ohio plant of a large automobile manufacturer. It consists of 4 Æ Perfect Spread Stokers, of the Continuous Ash Discharge type. Each unit has a normal capacity of 60,000 lbs. per hour, and maximum capacity of 70,000 lbs. per hour steam output.

**OTHER Æ PRODUCTS**—*Taylor Stokers—Lo-Hed Electric Hoists & Car Pullers—Hele-Shaw Fluid Power—Marine Deck Auxiliaries.*

## Æ PERFECT SPREAD STOKER

***with Traveling, Dumping or Stationary Grates***

A PRODUCT OF

**AMERICAN ENGINEERING COMPANY**

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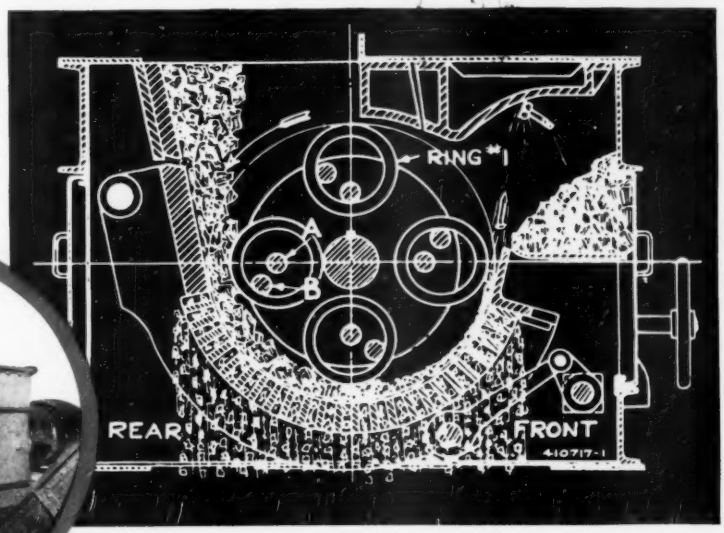
# LESS OVERGRINDING, MORE GRANULATION

## because the *RING GETS PUSHED*



## PENNSYLVANIA RING TYPE GRANULATOR

"Attrition" or "scouring action" is reduced to a minimum in the Pennsylvania *ring type* Granulator due to its "rolling compression" crushing action. The rotor is mounted with four rows of impact rings, which assume the position of Ring #1 on the suspension shafts "A" and "B" when the rotor is revolving and the Granulator is running empty.

During crushing, the feed forcibly displaces or unhangs the rings from their natural support on shaft "A", compelling them to take a new position, where they are supported and rotatively *pushed* by shaft "B" (patented). Because of this position the rings are centrifugally off balance, which means a powerful force is urging their return to their shaft "A" supports.

This return effort causes the rings to press hard on the on-coming feed, reducing it by a "rolling compression" at a speed as low as 400 to 450 RPM. Thus the scouring action (found in conventional hammer and ring mills) is greatly reduced, giving less extreme fines and a more granular product.

*Manufacturers of a complete line of crushing equipment • Hammermills • Single Rolls • Bradmills • Kue-Ken Jaws • Kue-Ken Gyracones • Granulators • Impactors • Bradford Breakers*

**PENNSYLVANIA CRUSHER COMPANY**

DIVISION OF BATH IRON WORKS CORPORATION

**Liberty Trust Building, Philadelphia 7, Pa.**

New York • Pittsburgh • Birmingham • Detroit • Chicago • St. Louis • Crosby, Minn. • Los Angeles

Associated with Fraser & Chalmers Engineering Works, London

# NEW

SERIES 12100*

FORGED STEEL

DROP

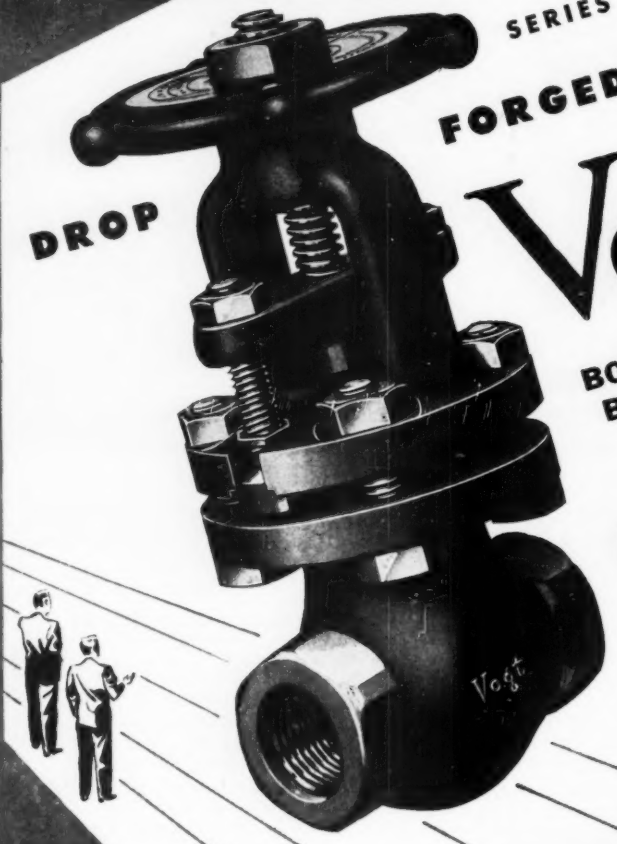
# Vogt

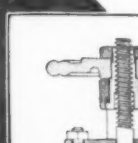
BOLTED BONNET
BOLTED GLAND

150-800 POUND

## GATE VALVES

SIZES 1/4" to 2"



*Series 12100

CARBON STEEL | 800 Pounds @ 750°F. | 1500 Pounds Cold Non-Shock

For 150-800 pounds service • Round Bolted Bonnet • Bolted Gland • Gasket or Ground Joint • Outside Screw and Yoke • Renewable Seat Rings • Solid Wedge — Slotted Type • Rising Stem 11½-13% Chrome Stainless Steel Trimmings • Sizes 1/4" to 2" inclusive.

**HENRY VOGT MACHINE CO. *Louisville 10, Ky.***

BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • ST. LOUIS • DALLAS

It takes more than a want-ad to get a power plant auxiliary and an Induction Motor working together. But there is a brisk demand for Induction Motors that have operating characteristics required to keep auxiliaries humming in the modern power plant. The E-M 2-pole Squirrel-Cage Induction Motor is designed specifically for such dependable teamwork.

In the illustration above, there are two 250 hp, 3560 rpm E-M Heavy-Duty Induction Motors of drip-proof construction. They are driving boiler feed pumps in the Hunlock Station of the Luzerne County Gas and Electric Corporation at Kingston, Pennsylvania.

For years a supplier of *Synchronous Motors* for power plants, E-M applies this wide knowledge of power plant requirements to the design of large Induction Motors for special high-speed drives.

A half century of specializing in big motor engineering shows in the way E-M Induction Motors are built for the most dependable kind of performance year after year. They are a triumph of big motor engineering, with their sturdy rotors; the multi-layer, impregnated insulation of their stator coils; their long-lived, cool-running bearings; strong frames of rolled steel plate; quiet operation, and job-engineered external protection against environmental hazards.

For full information, see your nearest E-M Sales Engineer, or write for our Publications 189 and 190.

**ELECTRIC MACHINERY MFG. COMPANY**
**MINNEAPOLIS 13, MINNESOTA**

1300 - TPA - 2085

**E-M**

**SPECIALISTS IN**
**BIG MOTOR ENGINEERING**

# HEAT IMPRISONED

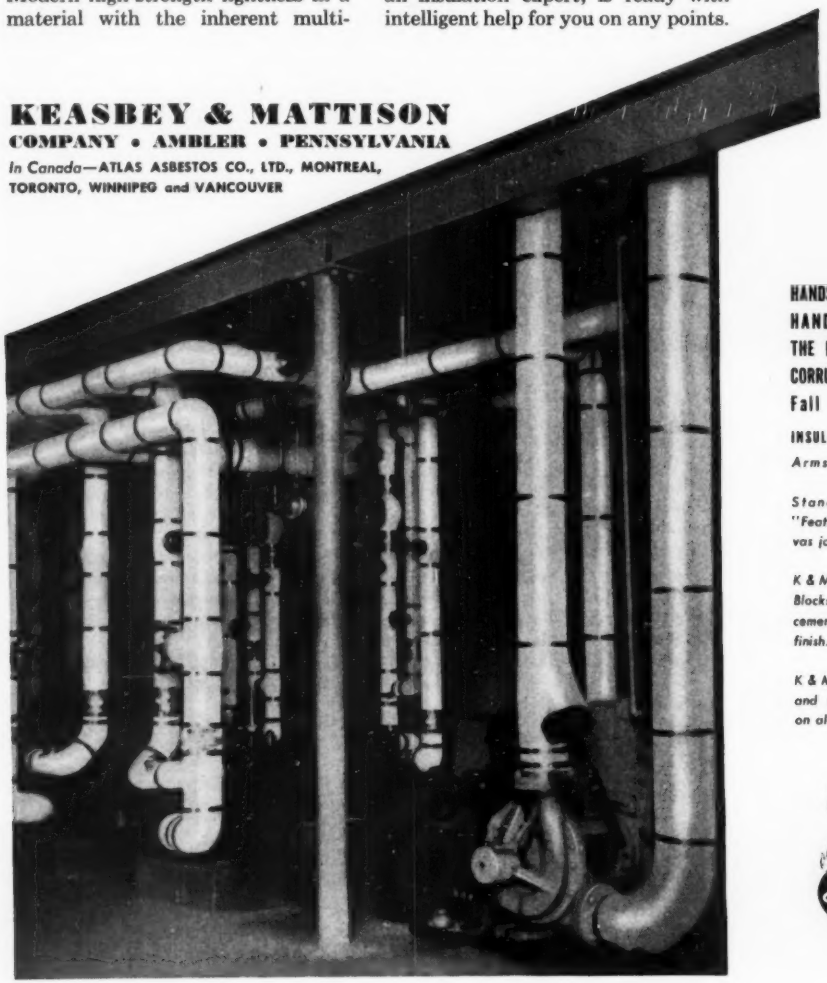
## BY K&M "FEATHERWEIGHT"® 85% MAGNESIA PIPE INSULATION

The fuel dollars, the power dollars, the production dollars, are what cannot escape at will, where K&M "Featherweight" Insulation imprisons the heat. K&M "Featherweight" cuts, fits and handles without waste effort and material. Maintenance expense is warded off, too, by the high physical strength of "Featherweight" and by its resistance to adverse atmospheric factors.

Modern high-strength lightness in a material with the inherent multi-cellular structure to keep heat in its place, is achieved by the K&M way of correctly compounding clean Asbestos Fibre with basic Carbonate of Magnesia.

Temperatures to 600° F don't overtax K&M 85% Magnesia Insulation. You can get it in all standard dimensions. You'll get assured economies, as with all the other K&M insulation materials. Your K&M Distributor, an insulation expert, is ready with intelligent help for you on any points.

**KEASBEY & MATTISON**
**COMPANY • AMBLER • PENNSYLVANIA**
*In Canada*—**ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER**



**HANDSOME DOES AS HANDSOME IS IN THE PLANT OF J & J CORRUGATED BOX CO., Fall River, Mass.**

**INSULATION CONTRACTOR:** *Armstrong Cork Co.*

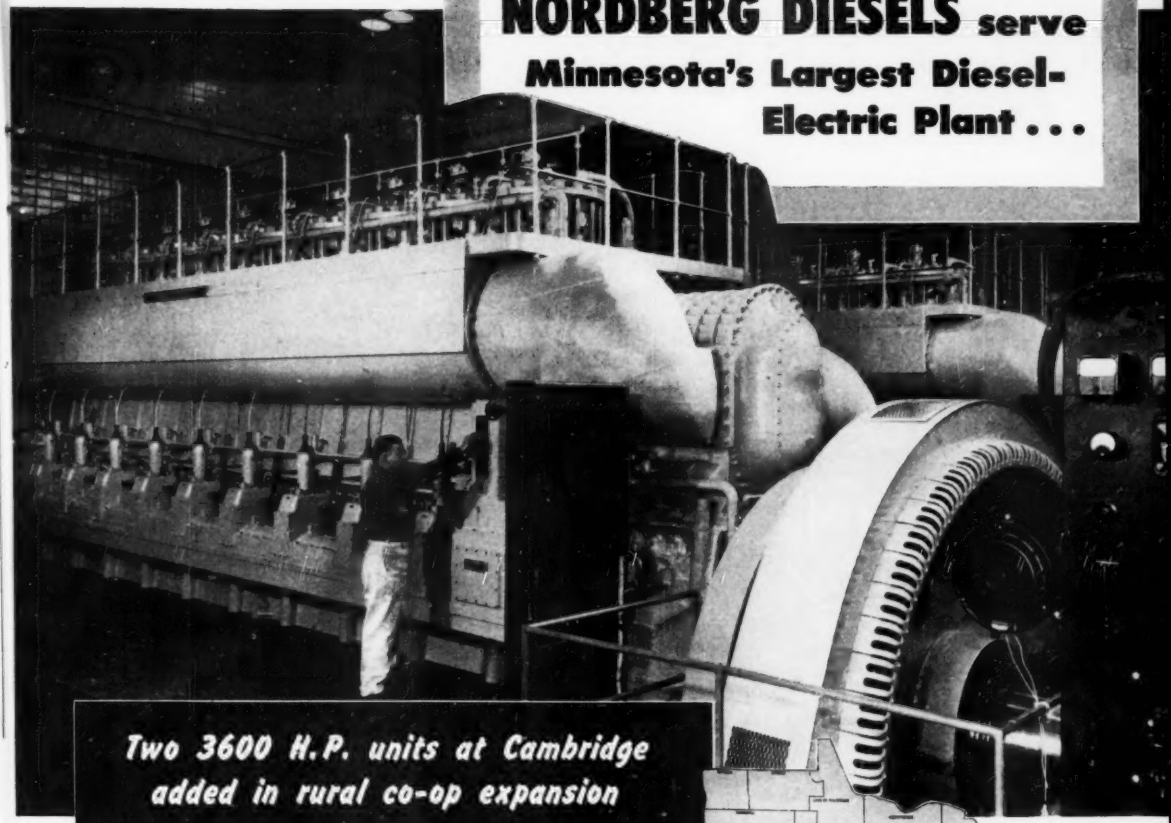
*Standard thick K & M "Featherweight" with canvas jackets, on all piping.*

*K & M 85% Magnesia Blocks on all flanges, with cement and canvas jacket finish.*

*K & M Asbestos Cement and canvas jacket finish, on all fittings.*

K&M best in asbestos ®

# NORDBERG DIESELS serve Minnesota's Largest Diesel-Electric Plant . . .



***Two 3600 H.P. units at Cambridge added in rural co-op expansion***

UP in the east-central section of Minnesota, several local co-operative power associations have joined forces to provide electric power for some 22,000 customers. Upon completion of their current expansion program, consumer capacity will be nearly doubled.

Part of this expansion centers around the generating station at Cambridge, where two new Nordberg Diesels were recently installed. Started in 1945 with one 1125 K.W. unit, this plant has increased its capacity twice. The latest addition of two 3600 H.P. Nordberg Diesels now brings the total capacity up to 7250 K.W. — making the Cambridge plant the largest Diesel installation in Minnesota.

The advantages of dependable, low cost, long life service built into every Nordberg Diesel, Gas and Duafuel Engine make these rugged units a leading choice for every power need — in sizes from 10 to 8500 H.P. Write for further details, outlining your requirements.

**NORDBERG MFG. CO.**
**MILWAUKEE 7, WISCONSIN**

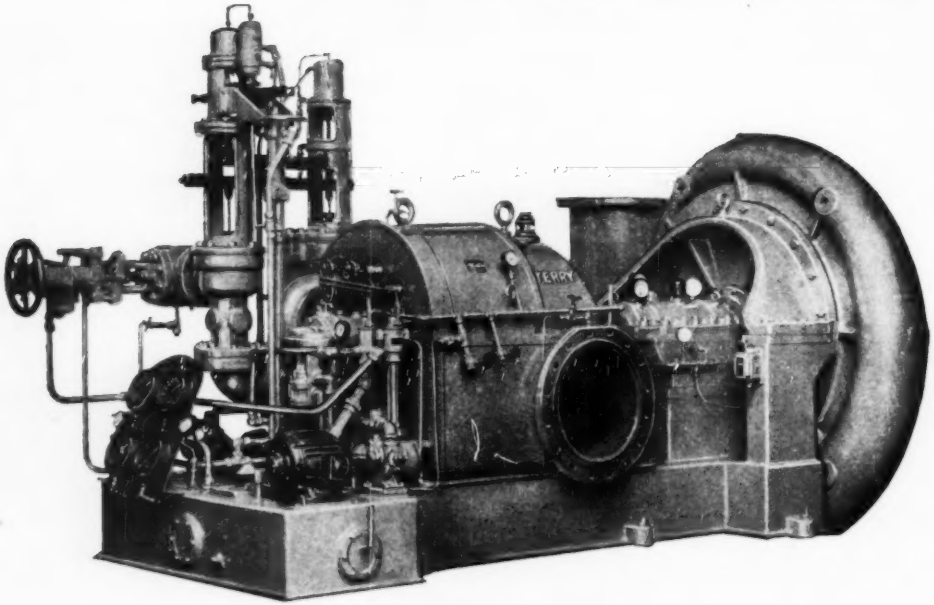
Map shows outside boundaries of the several Minnesota co-operatives being served from the main Generating Co-Op.
★ Indicates location of Cambridge plant.

P1149

A DIVISION OF NORDBERG

**NORDBERG**
**DIESEL ENGINES**

# *The* TERRY TURBINE




## SPECIAL PURPOSE TURBINE

**FOR OPERATION UNDER ALL THESE CONDITIONS:**

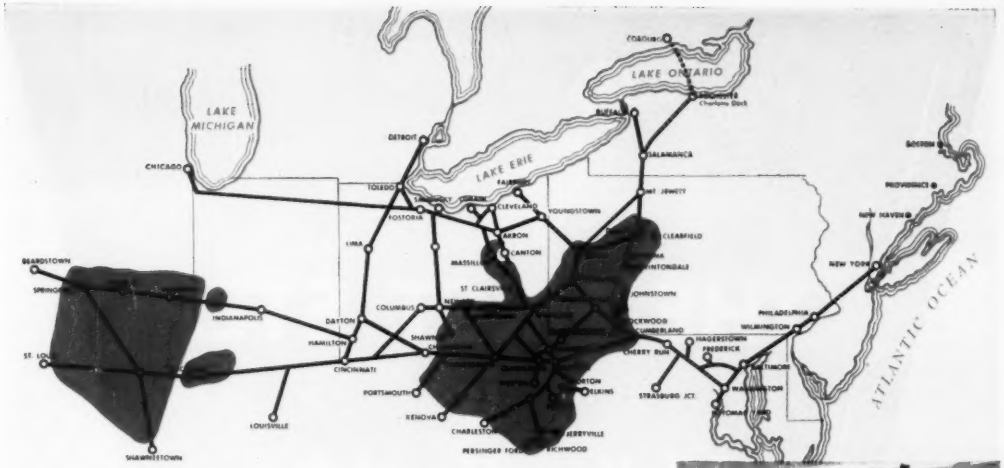
1. Straight, high-pressure, condensing
2. Straight, low-pressure, condensing—putting to work excess low-pressure steam.
3. Mixed pressure — using the low-pressure steam available, with only enough high-pressure steam required to drive the compressor
4. Condensing bleeder operation — providing clean, low-pressure steam for heating or process work

. . . and the speed under any of these conditions can be varied from 2800 to 4750 rpm.

This is but one example of many unusual combinations developed by Terry to meet out-of-the-ordinary requirements in turbines up to 2000 hp. Information on a special-purpose turbine for your specific requirements will be gladly furnished.

T1177

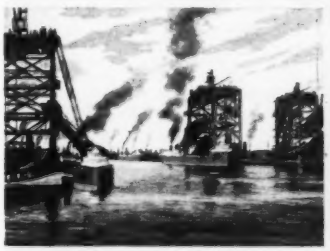
**THE TERRY STEAM TURBINE COMPANY**
**TERRY SQUARE, HARTFORD, CONN.**



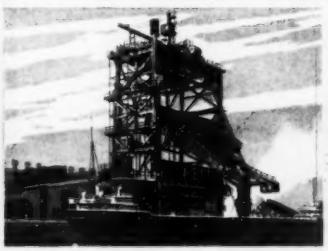

# *Coal is where you find it...*

## but economical B&O coals are within easy reach of the industries that need them

HOWLAND HOOK, Staten Island, N. Y.



COAL FACILITIES, Toledo, Ohio



COAL FACILITIES, Lorain, Ohio

CURTIS BAY, Baltimore, Md.

This map should interest you. Note where the vast Bituminous deposits on the Baltimore & Ohio lie —then observe the strategic position of B&O rails serving the heart of industrial America. This is accessibility—the plus that means economy when you buy coals on the B&O!

Through the great B&O ports of Lorain, Toledo, Fairport, and Buffalo on Lake Erie, and Charlotte on Lake Ontario, consumers in all the Great Lakes region and in Canada have access to B&O Bituminous. Terminals accessible to B&O at New York and Philadelphia, as well as B&O's own tidewater terminals at Curtis Bay, Baltimore, and Howland Hook, Staten Island, N. Y., place this coal on the doorsteps of Atlantic Coast consumers.

Because *Bituminous is basic*, B&O has spent more than $80,000,000 in the last three years to improve system-wide facilities for bituminous distribution. Wise consumers with an eye to efficiency, economy, wide variety, and vast reserves, "bank on B&O Bituminous." *Ask our man!*

BITUMINOUS COALS FOR EVERY PURPOSE

# BALTIMORE & OHIO RAILROAD

Constantly *doing things* —better!

# THE FIRST STEP
## is
## All You Need Take

**WHEN YOU TURN THE COMPLETE POWER PIPING JOB OVER TO P. P. & E.**

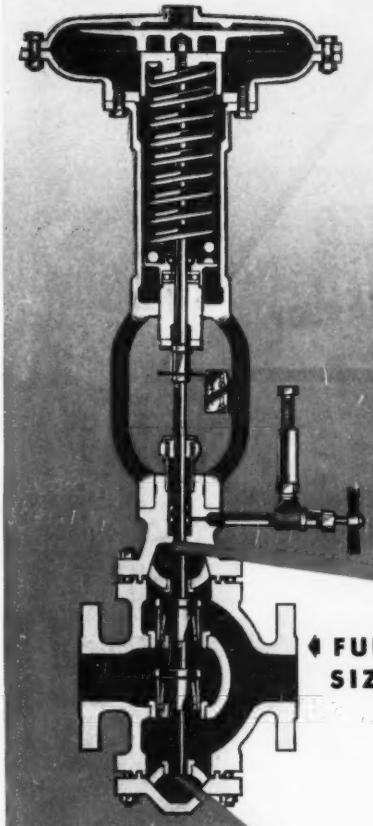
Just take one step when you need new power piping. Turn the complete job over to P.P.&E. By placing this responsibility in our hands you obtain the advantages of a distinctive engineering technique, complete shop fabrication facilities, specialized metallurgical control methods complete with model testing, and skill in meeting and solving present-day field erection problems. Furthermore, you are relieved of detail . . . and utilize to the utmost the knowledge we have accumulated through almost a half century of practical experience in this field. Ask our nearest representative for further information.

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston

# RESTRICTED INNER VALVE PROCEDURE FOR FISHER DIAPHRAGM CONTROL VALVES . . . . . .

The introduction of Fisher's new restricted inner valves offers a quick, economical and completely satisfactory way to reduce the effective capacity of a larger nominal valve size.



## INTERCHANGEABLE

FULL SIZE

1 SIZE SMALLER

2 SIZES SMALLER

## PRACTICAL

For example, a 4" valve can quickly be converted to flow capacity of a 3" 2½", or 2" size. This is accomplished by the restricted V-Port Inner Valve alone—without changing seat rings. Inner valves with equivalent smaller size valve area or capacity are fully interchangeable with standard full size inner valves. Inner valve skirts are cast stainless steel with wide range percentage characteristics port areas. Cast skirts are welded on to stainless steel bar stock center post guide. Further details and application data gladly furnished on request.

**FISHER GOVERNOR COMPANY** MARSHALLTOWN, IOWA

# "Food" FOR BOILERS
# ECONOMICALLY STORED
# . . . EASILY RECLAIMED

## COAL HANDLING SYSTEM AT NEW AMERICAN ENKA PLANT DESIGNED AND BUILT BY FAIRFIELD

Sole responsibility for prompt job completion . . . a wealth of experience for smartest engineering . . . and industry acceptance that guarantees satisfaction, are important considerations to remember when capital equipment expenditures are to be made.

These are a few of the many points in favor of consulting Fairfield before you contract for your coal and ash handling equipment.

Regardless of what your coal and ash handling demands are, Fairfield would welcome the opportunity to serve you. A Fairfield engineer from our nearest office will be glad to discuss your coal or ash problems with you. Write today for this service. No obligation.

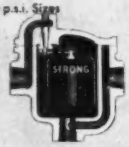
Distributing belt conveyor over bunker. Automatic tripper in background.

View down catwalk alongside elevator belt. Note extensive ground storage acreage.

**THE FAIRFIELD ENGINEERING COMPANY**

**Builders of Dependable Coal and Ash Handling Equipment**

Inverted bucket trap. All stainless fitted. To 250 p.s.i. Sizes ½" to 2½".




Inverted bucket in-line trap. To 250 p.s.i. Sizes ½" to 1".

Inverted bucket blast trap (thermal air by-pass). Sizes ½" to 1".

Open bucket trap. Semi-steel or cast steel. Sizes ½" to 3".

Ball float trap for draining air line or venting service. To 200 p.s.i.

## HERE'S WHY YOU SHOULD BRING YOUR STEAM PROBLEMS TO

# STRONG

**1.** Over 40 years' specialized *engineering experience* in all types of steam problems;

**2.** Completeness of the STRONG line gives you the added advantage of choosing *exactly* the *right* size and type of steam specialty to meet your *individual* need;

**3.** Acceptance of STRONG products as *standard* by outstanding engineering firms and large users;

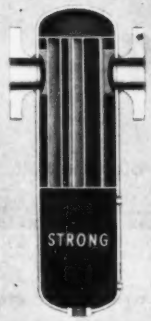
**4.** Advanced engineering design to maintain *leadership* in the field.

Insist on genuine STRONG steam specialties and repair parts for reduced maintenance and increased production. A large staff of STRONG factory-trained field engineers is at your service. Bring your next steam problem to STRONG*.

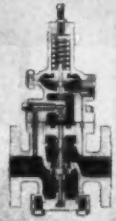
**STRONG, CARLISLE & HAMMOND COMPANY**
**1392 West 3rd Street · Cleveland 13, Ohio**

*Trade Mark Reg., U.S. Pat. Off.

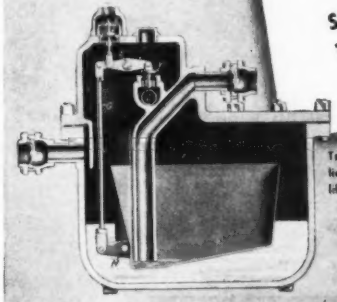
Forged steel inverted bucket trap. To 1,800 p.s.i. Sizes ½" to 2".




Fabricated horizontal or vertical steel separator. Sizes ½" to 10".

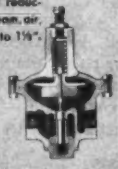


Pilot operated pressure regulator for steam, air, gas. Sizes ½" to 4".



Trap for removing liquids from vacuum or lifting (pumping) service.

Quick cleaning strainer. Semi-steel and cast steel. Sizes ¼" to 4".



Direct operated reducing valve for steam, air, gas. Sizes ¼" to 1¼".

Block steel valve for continuous blowdown or throttling service.

REG. TRADE MARK

SPECIFY ANUM-METL Reg. Trade Mark

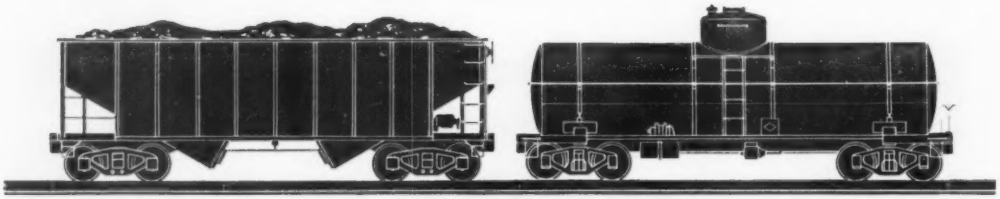
# STRONG

STEAM SPECIALTIES

***SEND FOR NEW STRONG CATALOG!***

Complete, up-to-date specifications and prices on entire Strong line including steam and lifting traps, reducing valves, separators, strainers, continuous blowdown valves, and engine stops. Valuable tips on piping and trap sizing, etc. Write for Catalog 68 today!

# NO MATTER HOW FUEL COSTS FLUCTUATE



# You're Sure Of Combustion Economy By Using...

**ENCO**

**OIL BURNERS WITH COAL FIRED UNITS**

YOU CAN ALWAYS TAKE ADVANTAGE of the best market price of fuel when your power plant is equipped with Enco Oil Burners in combination with coal burning units. You can readily change from coal to oil — and back to coal. Comparative BTU costs and fuel availability are the only governing factors.

*With Pulverized Coal Burners,* you can use either Enco Mechanical or Steam Atomizers for ignition and entire load range because both oil and coal are finely divided fuels that burn in suspension. Bulletin OB-PC contains complete details on use of Enco Oil Burners with Pulverized Coal. A copy will be sent on request.

*With Stoker or Hand Fired Units,* this same combination can be made for partial or full loads, either for temporary or permanent application. Complete information on installations of this type will be sent on request.

**BULLETIN OB-PC GIVES FULL INFORMATION ON THESE ENCO UNITS**

★ ★ ★

**ENCO INTERCHANGEABLE FUEL OIL ATOMIZERS**

Enco Wide Range Mechanical Atomizer Gun

Enco Straight Mechanical Atomizer Gun

Enco Steam or Air Atomizer Gun

Enco Interchangeable Atomizer Gun Support

Enco Automatic, Retractable Oil-Electric Ignition System

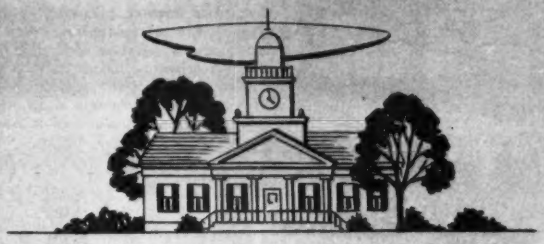
EC-478

**THE ENGINEER COMPANY**

70 WEST STREET, NEW YORK 6, N. Y.

Canadian Representatives: F. J. Stokie, Ltd.

4220 Sherville St., Montreal 34, P.Q.



# YOUR COMMUNITY

**needs the safety**

**and lasting dependability of**

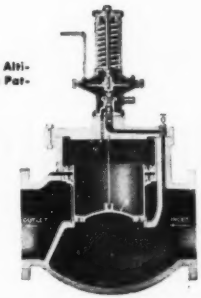
# GOLDEN-ANDERSON

**positive control** # VALVES

Sensitive Golden-Anderson Altitude Control Valves maintain water levels within 3" to 12" variations, and may be arranged with special equipment to perform a variety of other services.

Inherent water cushioning prevents shock or jar under varying flow conditions. These Valves are easily adjusted for any water level, and include an indicator which shows piston position at all times. Some models actually are two valves in one—a regular automatic Altitude Control Valve as well as a Reverse Flow Check Valve.

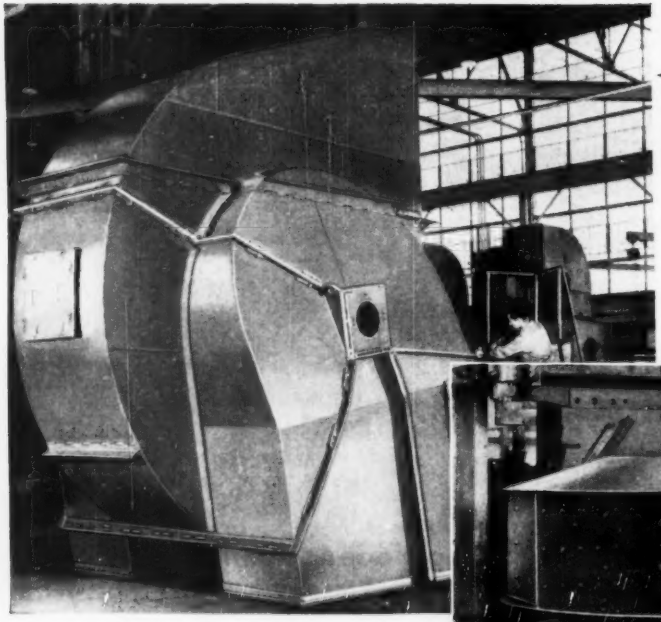
Let Golden-Anderson protect life and property through *absolute, safe control* of difficult flow conditions.



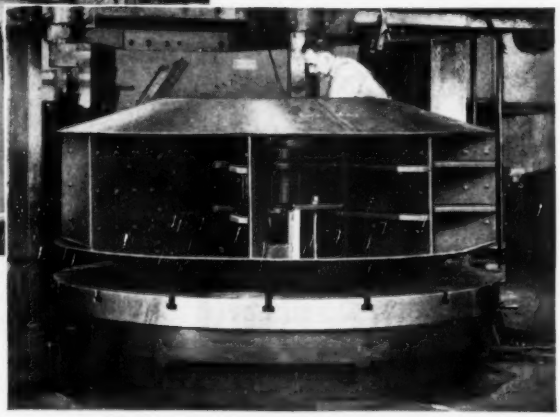
G-A Single Acting Altitude Valve, Globe Pattern.

**GOLDEN-ANDERSON *Valve* Specialty Co.**
**Keenan Building, Pittsburgh 22, Pa.**

LIFE AND PROPERTY PROTECTION
VALVES SINCE 1905



**American Blower** Induced Draft Fan in early stages of construction. Photo shows fan in reverse elevation position with upper flanges representing foundation level. Rating, 170,000 cfm, 300° F, 26" sp, 698 rpm, 978 bhp, 21,000 tip speed. Housing is of ¾" steel with all-welded construction and welded steel inlet boxes.



**Boring mill** operation—wheel is radial blade type—115" diameter, weight, 7600 pounds. Shaft diameter is 15" and includes 8" water-cooled, self-aligning type bearings. Wheel has special spider design, is of extra-heavy construction and is provided with replaceable blade wearing pads.

# Building for the future

**Here,** Bill Kociemba and Joe Waller, with years of experience on American Blower Air Handling Equipment, are building for the future.

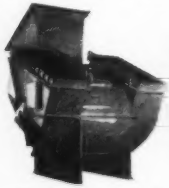
The object of their attention, in terms of the trade, is an American Blower Induced Draft Fan suitable for handling induced draft or hot gas exhaust.

These men, like all American Blower craftsmen, know by experience that there's only one way to build for the future. That way is to make each product so well that when another is ordered, American Blower will be specified.

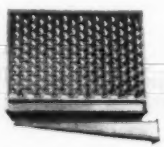
How about your plans for the future?

If they include modernizing, replacing obsolete equipment or plant expansion, it will pay you to call an American Blower Branch Office. Our engineers will gladly cooperate with you, without cost or obligation, on any problem involving air handling.

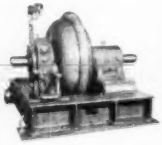
**AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN**
**CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO**
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION



HS and Sirocco Fans for forced or induced draft in all types of power plants.



ST Fly Ash Precipitators—especially for power plants burning pulverized fuel.



Type VS Gyrol Fluid Drive—for adjustable speed control of mechanical draft fans.

AMERICAN BLOWER

**AMERICAN BLOWER**

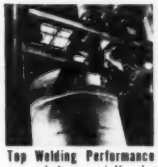
*Serving home and industry*

**AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILER • ROSS HEATER • TONAWANDA IRON**

**Metallurgical Research** conducted continually by recognized specialists who have made major contributions in this field.

**Unique Technical Backing** of an extensive organization with an international reputation in both process and fabrication engineering.

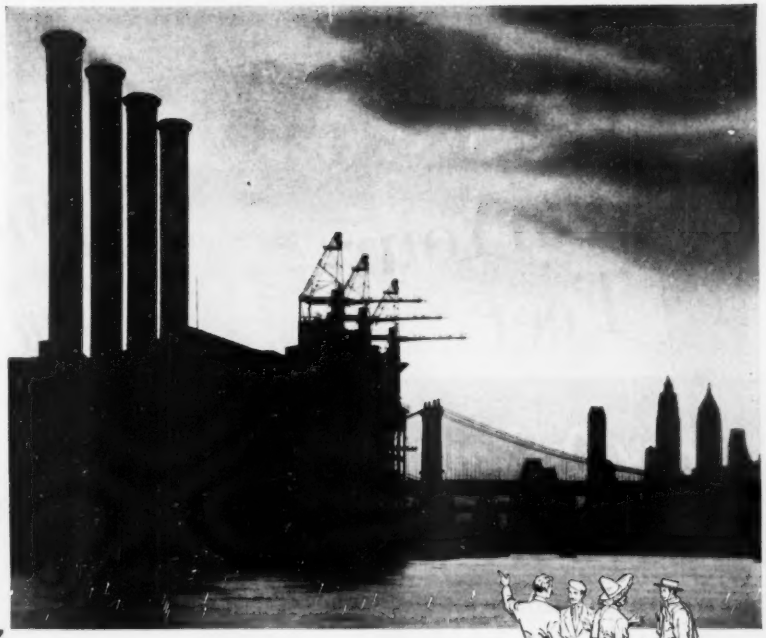
**Complete Facilities** for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.



**Top Welding Performance** assured by specially designed equipment and exclusive employment of master operators.

**Quality Control** embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

**On-Time Delivery** made possible by a flexible planning group authorized to re-route work to meet promised dates.



# What José tells Joe

WORD certainly gets around.

Kellogg's only fabricating shop for high pressure and high temperature piping is in Jersey City. Yet orders for power piping continue to come not only from the logical sales areas but also from Europe, Central America, South America and from half a dozen different geographical centers in the U. S. A.

Why? The answer we like to believe is that the word gets around that Kellogg installations leave no undesirable after-taste, that, to use a prosaic phrase, they leave only satisfied customers. And they should, because "built into" each installation are certain factors that virtually guarantee better than average performance and service life.

For example, there's extensive "creep-testing" of high temperature materials being conducted in Kellogg's metallurgical Laboratory. And there's the concurrent, continuous study of *graphitization*.

There's the exclusive apparatus for the *determination of stresses* in complicated piping installations. There are the *shop fabricating techniques* and *shop quality check system* that are considered among the best in industry.

There are the *field installation methods* that were nurtured on penstocks and matured on the field construction of more than half of the world's refinery cracking capacity.

And beyond these, there are *more than thirty years* of successful completion of the highest temperature and highest pressure power piping – including installations in some of the world's largest power plants.

These are the reasons why the word about M. W. Kellogg power piping gets around when José talks to Joe, or whenever and wherever in the world power men meet.

*To master temperature, pressure and chemicals use*

## M. W. KELLOGG

*process equipment*

**VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING**
**PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS**

*The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman, Inc.) – Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.*

# Easy On Your FUEL BILLS

## PREFERRED UNIT STEAM GENERATORS

The E. T. Wright factory at Rockland, Mass. — where Wright *Arch-Preserver* shoes are made — is heated by an economical Preferred Unit Steam Generator.

This Wright installation was tailored to specific job requirements by Buerkel & Co. of Boston, contractors and engineers, to provide dependable, automatic operation with low maintenance and maximum efficiency. Hundreds of custom-built Preferred Units are generating low cost steam, *often cutting fuel bills as much as 40%*. Preferred Generators also eliminate costly stacks . . . reduce repair bills . . . help avoid expensive shutdowns.

Investigate the application of a Preferred Unit Steam Generator to your specific requirements. You'll find the full story on why Preferred Generators use less fuel, require less attention, in our new bulletin 1000-F. Write for your copy today.

### ENGINEERING FEATURES

**1. Fully Automatic Operation even with Bunker C, No. 6 including the new catalytic residuals and all types of commercial gas.**

**2. Induced (Pull-through) Draft, a distinctive feature, eliminating the necessity of building costly stacks. Only a simple vent to the outside air is required. No escape of products of combustion into the boiler room.**

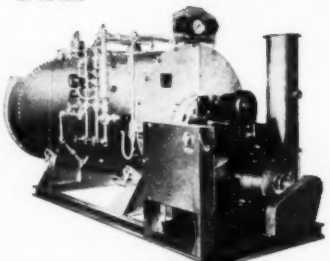
**3. Preferred Rotary Oil Burner — belt driven — 4600 RPM cup speed — patented Voluvalve for dependable fuel regulation — built especially for this unit.**

**4. Four-Pass Down Draft Gas Travel results in maximum heat absorption.**

**5. 80% Minimum Thermal Efficiency proved and guaranteed.**

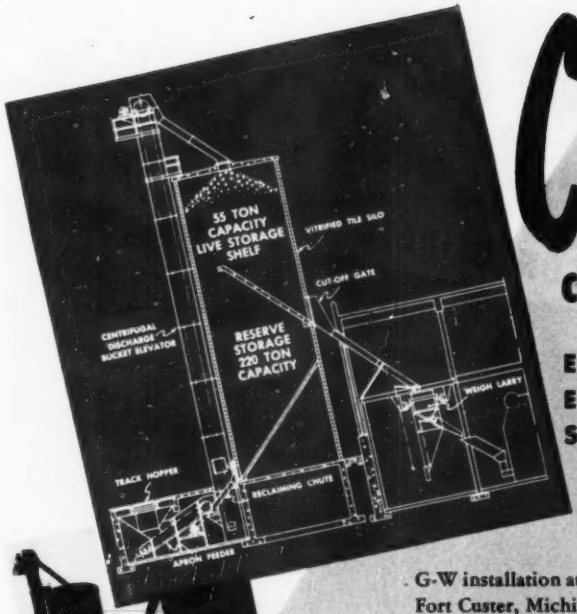
**6. Low Maintenance — the result of over 28 years of combustion engineering experience.**

**7. Full Range of Sizes — from 20 to 500 h.p. and pressures of 15 to 250 lbs. Two-pass units in 20 and 30 h.p. with pressure of 15 lbs.**



**PREFERRED UTILITIES MANUFACTURING CORPORATION • 1860 BROADWAY, NEW YORK 23, N.Y.**

**PREFERRED UTILITIES MFG. CORP.**




# Check YOUR coal handling costs

## EXCESSIVE EXPENSE COULD EASILY PAY FOR THIS G-W SYSTEM IN A SHORT TIME

Obsolete equipment and methods can easily absorb, in *excessive handling costs,* the outlay required for this modern G-W installation at the Veterans Administration Hospital, Fort Custer, Michigan.

Here, G-W engineers designed this Vitrified Tile Silo and handling equipment as the most efficient system *for maintaining coal handling costs at a minimum.* One of G-W's *four basic designs,* it incorporates a reclaiming system which utilizes the entire capacity of the silo as live storage. G-W Vitrified Tile Silos are low in first cost, can be quickly erected, and are durable and architecturally harmonious.

G-W Vitrified Tile Silo Storage System at Veterans Administration Hospital, Fort Custer, Mich. Capacity, 25 tons/Hr. Silo: 18'0" Diam., 55'0" high. Storage Capacity: 275 tons, with 55-ton live storage shelf and 220-ton reclaimable live storage. G-W 1500-lb. Weigh Larry with recording beam.

135 years of experience have taught G-W engineers that, although no two coal handling problems are exactly alike, practically all of them boil down to 4 *basic designs* for storage and handling.

**4 BASIC WAYS TO CUT COAL HANDLING COSTS**

No matter how different or difficult your coal (and/or ash) handling problem may be, from one of *4-basic types . . . Concrete Silos, Vitrified Tile Silos, Cylindrical Steel Tank,* and *Suspended Steel Bunker* . . . G-W engineers can install the most efficient and economical storage and automatic handling system to fit your conditions of space, capacity and allowable initial cost.

Fourteen interesting case histories, based on these 4 *G-W basic designs,* are described in Bulletin No. 300. Write for your copy, today.

**GIFFORD-WOOD CO.**

SINCE 1814

NEW YORK 17 — 420 LEXINGTON AVE.

Factory: Hudson, N. Y.

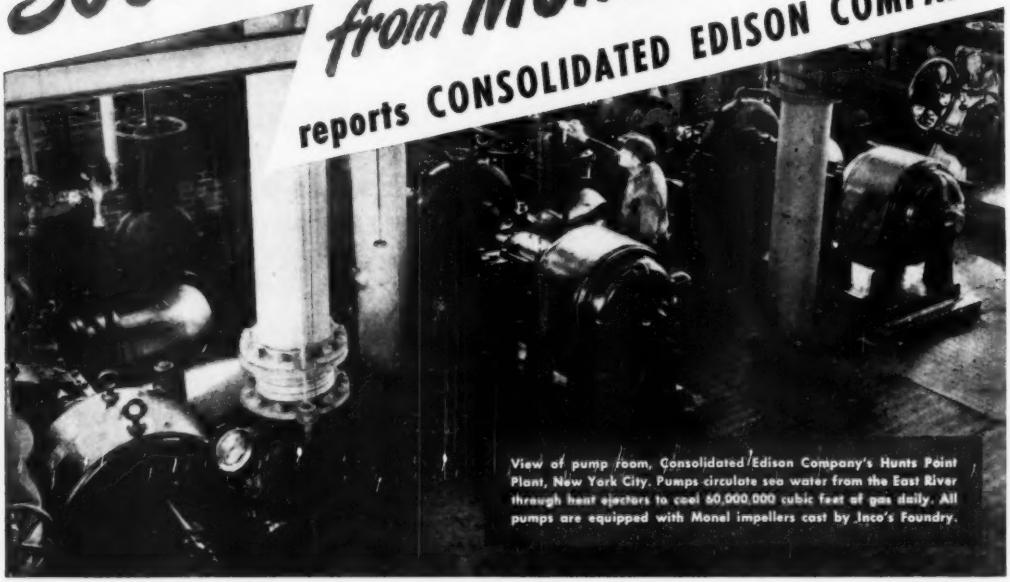
CHICAGO 6 — 363 W. WASHINGTON ST.

**G-W HANDLES IT... faster • easier • cheaper**

5885

# 300% Longer Life from MONEL Impellers...

## reports CONSOLIDATED EDISON COMPANY



View of pump room, Consolidated Edison Company's Hunts Point Plant, New York City. Pumps circulate sea water from the East River through heat ejectors to cool 60,000,000 cubic feet of gas daily. All pumps are equipped with Monel impellers cast by Inco's Foundry.

At the Hunts Point plant of the Consolidated Edison Company, cooling pumps circulate as much as 25,000 gallons of water a minute to cool the oven and water gas produced.

Cooling water is drawn from New York's East River. This water...sewage-polluted sea water...is highly corrosive. As might be expected, the destructive action of such water ruined pump impellers at a serious rate. Every eighteen months, on the average, the impellers of Consolidated Edison's five cooling pumps had to be replaced.

To solve this troublesome and costly maintenance problem, Consolidated Edison engineers tried impellers of Monel®, cast at Inco's Bayonne foundry. Result? Read this service summary:

**"300% *longer life* has resulted from a change to Monel for the cast impellers of circulating pumps at the Hunts Point plant. In this service, impellers made of a nonferrous alloy lasted an average of 18 months before erosion and corrosion destroyed their efficiency. In 1938, the first Monel impeller was installed. Since then, all the pumps have been regularly equipped with Monel impellers. *They have averaged four to five years apiece*—better than three times longer than the previous impellers."**

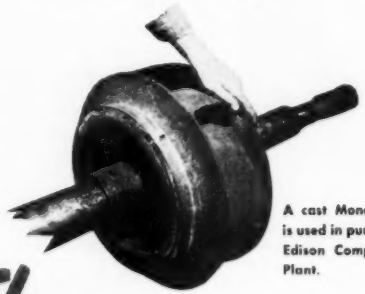
If you have problems involving erosion, corrosion, or excessive wear, why not do as Consolidated Edison Company did . . . try tough, rustproof, corrosion-resistant Monel? You'll find that Monel and other Inco Nickel alloys can greatly extend the life of pumps, valves, tanks, heat exchangers, and other equipment. Inco's Technical Service Department will gladly make recommendations.

Write for your copy of *"How to Get Longer Service from Your Pumps."*

®Reg. U. S. Pat. Off.

**THE INTERNATIONAL NICKEL COMPANY, INC.**

***67 Wall Street, New York 5, N. Y.***



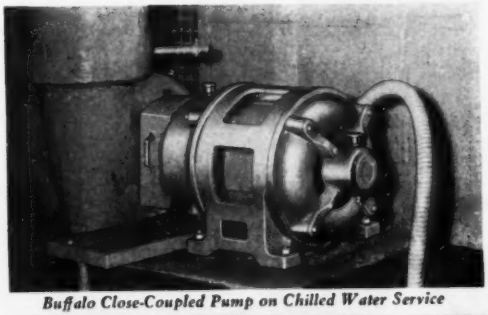
**A cast Monel impeller such as is used in pumps at Consolidated Edison Company's Hunts Point Plant.**

EMBLEM OF SERVICE INCO

# MONEL

## ...FOR MINIMUM MAINTENANCE

# Haven't Had A Minute's Trouble Since We Put In "Buffalo" Pumps



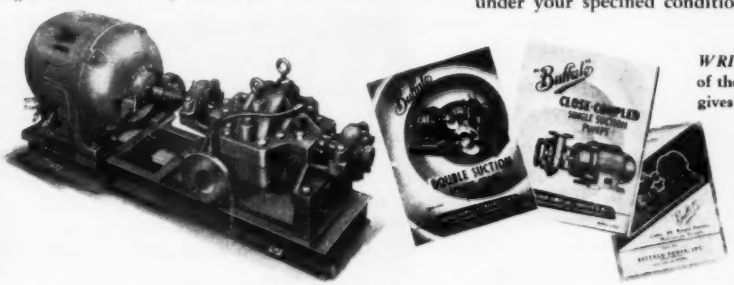
*Buffalo Close-Coupled Pump on Chilled Water Service*

*Buffalo Class "SL" Pump Handling Condenser Water*

**—AND THAT, PLUS EFFICIENCY, MEANS REAL ECONOMY IN CLEAR WATER PUMPING**

● Ask any user of clear water pumps—the pump you can "forget about" is the one that's saving you money! And from on-the-job reports of "Buffalo" Pumps, we know that they are piling up savings for users, both in maintenance and power consumption. That's because all "Buffalo" Pumps are built ruggedly—and because they're built for efficiency—impellers and water passages designed to handle maximum water with minimum resistance.

Best of all, in the "Buffalo" line, you can match the pump to *your* service and *your* conditions. For boiler feed, for air conditioning applications—for almost any pressure and capacity — there's a "Buffalo" Pump ready to give you worry-free service—and each one passes a thorough load test under your specified conditions before shipment.




*Buffalo Class "RR" Pumps for Boiler Feed and Other Clear Water Service*

*WRITE* for your free copies of these bulletins! No. 955-N gives engineering facts on "Buffalo" Type "SL" Pumps; No. 960-B on Type "RR" Pumps; and No. 975-B, on "Buffalo" Close-Coupled Pumps.

"Buffalo" PUMPS

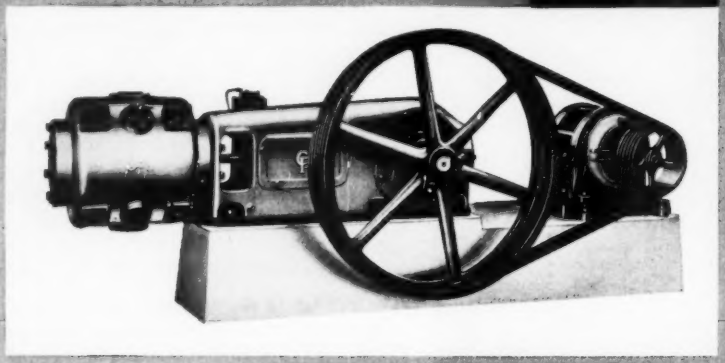
**BUFFALO PUMPS INC.**

488 BROADWAY BUFFALO, NEW YORK

Canada Pumps Ltd., Kitchener, Ont.

**A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID**

# years of satisfactory service prove dependability of Type T



This horizontal, straight-line, double-acting, moderately rated compressor is noted for continuous, economical operation . . . low maintenance . . . long life.

Its special features include Simplate valves . . . liberally water-jacketed cylinder and heads . . . adjustable, tapered roller main bearings . . . double-counterweighted crankshaft.

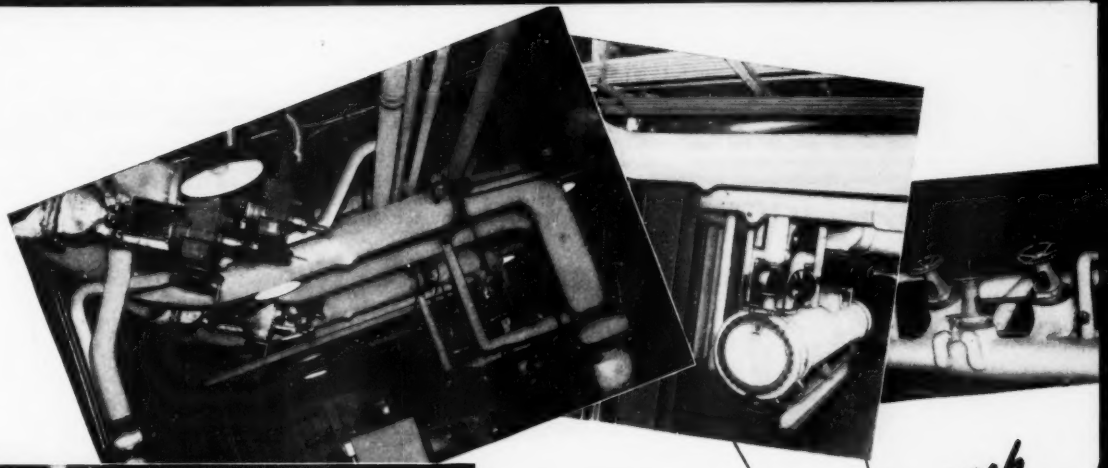
CP Type T Compressors are furnished in single stage units from 89 to 1937 c.f.m., 15 to 125 H.P., with V-belt, flat belt, and direct-connected synchronous motor drive. Multi-stage designs for pressures up to 5,000 pounds, and steam-driven types are also available.

Write for Bulletin 728-J.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



*Piping puts the push into power generation*

From the 10-inch chrome-moly header built to carry 900 P.S.I. at 950°F down to the tubes leading to instrument panels, every piece of pipe in a great power generating station should have the engineering skill and scientific care in its production which these products of Power Piping Division received before and during their installation. *Piping is power's big factor.*

**POWER PIPING DIVISION** of Blaw-Knox Construction Co.
1525 PENNSYLVANIA AVENUE, PITTSBURGH 12, PA.

# BLAW-KNOX *Power Piping*

**RECORDING FULSCOPE* CONTROLLER**

For desuperheaters, or for any close, accurate control of temperature, pressure, flow or liquid level. Quickly adapted to any operating requirements.

**RECORDING THERMOMETER OR PRESSURE GAUGE**

Ideal wherever you need a record of pressure, temperature or a combination of both. Accurately records steam and feed water temperatures and pressures or oil, air and flue gas temperatures.

**TAYLOR DIAL THERMOMETER**

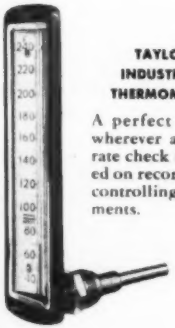
For transformers, coal-air mixture in powdered coal ducts, air compressor discharge, turbine and generator bearings. Available with electric alarm devices.

# SAVE STEAM

## with Taylor Cost Cutters like these

STOP those dollars from going up in steam! Let Taylor Instruments help you get credit for increasing operating efficiency and cutting costs. Select what you need from our complete line of instruments for accurate measurement or control of temperature, pressure, flow and liquid level. Ask your Taylor Field Engineer! Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

*Taylor Instruments*
*MEAN*
*ACCURACY FIRST*
IN HOME AND INDUSTRY



**TAYLOR INDUSTRIAL THERMOMETER**

A perfect choice wherever an accurate check is needed on recording or controlling instruments.

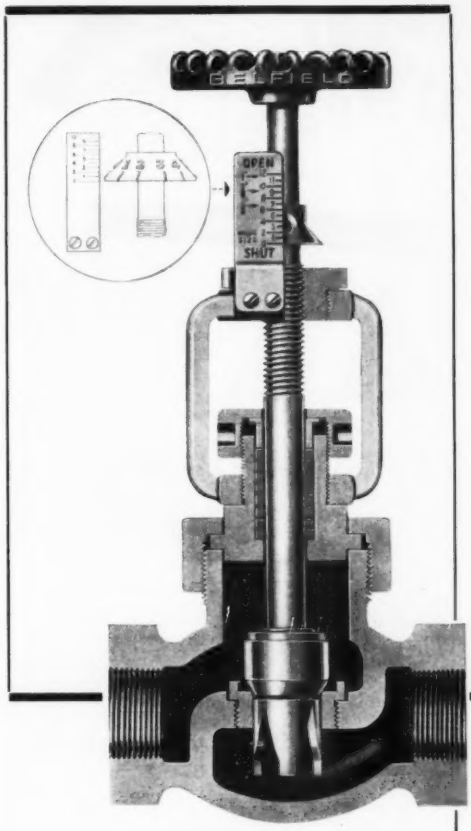
**TAYLOR SELF-ACTING TEMPERATURE CONTROLLER**

For dependable control on hot water storage tanks, air compressor jacket water.

**ARMORED ETCHED STEM THERMOMETER**

Ideal wherever you need a test check on temperatures. Also available in unarmored types.

* Registered Trade Mark




*See above illustration

FOR

# HIGH-PRECISION

## IN HAND CONTROL OF FLOW

## INVESTIGATE THE

# Belfield Hi-Lift

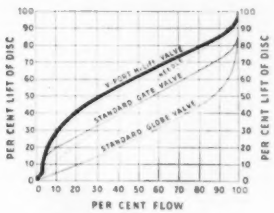
## HAND CONTROL VALVE WITH MICROMETER INDICATION

THE Belfield Hi-Lift Hand Control Valve is ideal for use where automatic regulation is not necessary or advisable. It was designed to provide micrometer adjustment of flow . . . contains an indicating scale to show percentage of stem travel to 1% and an inner valve capable of responding to such close correction. Inset illustration shows the simple and easy-to-read scale and the curve at left portrays the superior characteristics of the Hi-Lift Valve over conventional designs.

The Belfield Hi-Lift is available with v-port* or parabolic discs . . . in sizes from ¼" to 8" . . . straight through or angle . . . for pressures up to 600 lbs. . . . with body of Bronze*, High-Tensile Iron or Cast Steel . . . and with Bronze or Stainless Steel trim.

Call in your local Honeywell engineer for detailed information about the Hi-Lift and such other Belfield Process Control Specialties as: Transfer Valves, Liquid Level Devices, Steam-Jacketed Rotary Cocks and the Belfield Space-Saving Bypass.

*Write, today, for a copy of Bulletin #242-1*


PER CENT LIFT OF DISC
PER CENT FLOW
V-PORT HI-LIFT VALVE
STANDARD GATE VALVE
STANDARD GLOBE VALVE
0 10 20 30 40 50 60 70 80 90 100

*Flow characteristics of the Belfield Hi-Lift Hand Control Valve far surpass those of conventional designs . . . offer favorable comparison to the precision of such diaphragm operated control valves as the Belfield Series 700.*

BELFIELD VALVES — WORLD'S LARGEST ORGANIZATION FOR ADVANCED INSTRUMENTATION AND CONTROL

**MINNEAPOLIS-HONEYWELL REGULATOR CO.**
**BELFIELD VALVE DIVISION**
**Philadelphia 44, Pa.**
*Offices in 73 principal cities of the United States, Canada and throughout the world*

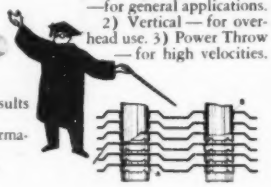
Honeywell — Process Control Specialties — Belfield VALVES

# Things to think about when selecting Unit Heaters

## DISCHARGE AIR TEMPERATURE*

Teeter-totter temperatures are out of the question in buildings heated by Modine Unit Heaters. Modine's *right* combination of correct outlet temperature and sufficient air velocity heats all parts of a room uniformly, even in coldest weather.

Modine's wide line gives you the right unit for your needs: 1) Horizontal —for general applications. 2) Vertical — for overhead use. 3) Power Throw — for high velocities.



Higher heat transfer results from quality Modine construction which permanently seals flanged collars of fins (A) to tubes (B) by means of metallic bond.

**For maximum comfort and lowest operating cost, temperature of air leaving unit heater should be between 110°-120°F. at standard conditions.*

## LOWER COSTS

Fuel bills shrink when you heat with Modines. Here's why. Modine Unit Heaters — combining correct outlet temperatures with sufficient air velocity — deliver heat down into comfort zones where it's needed . . . don't waste it on ceilings or above the heads of room occupants.

Direct-from-pipe suspension is safe and practical with Modine horizontal models. *This cuts installation costs . . . permits easy redirection of heat over a 360° range.*

*Lower power and motor maintenance costs* result from Modine's use of only high-quality, totally enclosed split-phase or capacitor motors on all but only the smallest Modine Unit Heaters.

## LONGER LIFE

Modine Unit Heaters are built to last. With the complete condenser constructed of pure copper and copper alloy . . . with tubes of red brass, fins and headers of copper, you get maximum resistance to electrolysis and corrosion.

Differential expansion stresses are safely absorbed in individual tubes. Fins are permanently bonded to tubes with metal. All condenser joints are brazed.

Parker-Bonderizing protects casings and sheet metal parts against formation and spread of rust. Anchors paint to steel. Prolongs original attractive finish.

# Modine
## UNIT HEATERS

**Yes . . . look beyond BTUs** when buying Unit Heaters. Look to Modine! You can get all the facts by calling your nearest Modine Representative. He's listed in the classified section of your phone book. Or write direct. Modine Mfg. Co., 1512 Dekoven Ave., Racine, Wisconsin.

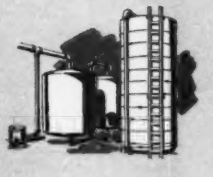
***Ask for the new Modine Unit Heater Bulletin 149A. Also available on special request is the informative booklet — "Here's How to Evaluate Operating Characteristics of Suspended Unit Heaters." Send for them today!***

U-1037

# five basic power plant processes...

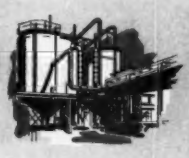
**ZEO-KARB SOFTENER** The Permutit Zeo-Karb® Softener removes both hardness and bicarbonates from raw water. The effluent is soft and reduced in total solids and alkalinity. The sulphate-carbonate ratio may be adjusted as desired by a system of mixed effluents.

**SILICA REMOVAL PLUS DEMINERALIZATION** Demineralization by cold ion exchange processes produces water of comparable quality to distilled water at a small fraction of the cost of distillation. Treatment by an anion exchange resin, Permutit S,® reduces silica to less than 0.5 ppm.



**DEAERATING HEATER** The Permutit Deaerating Heater, utilizing exhaust or bled steam, prevents corrosion of feed lines, stage heaters, economizers, and boilers by removing *all* oxygen and free $CO_2$. Capacities from 12,500 to 1,400,000 pounds per hour are in service.

**SLUDGE BLANKET HOT LIME SODA** The application of the sludge blanket design to hot lime soda treatment gives you soft water of a low silica content. Lower turbidity eases the load on the filters... savings in operating costs are substantial.

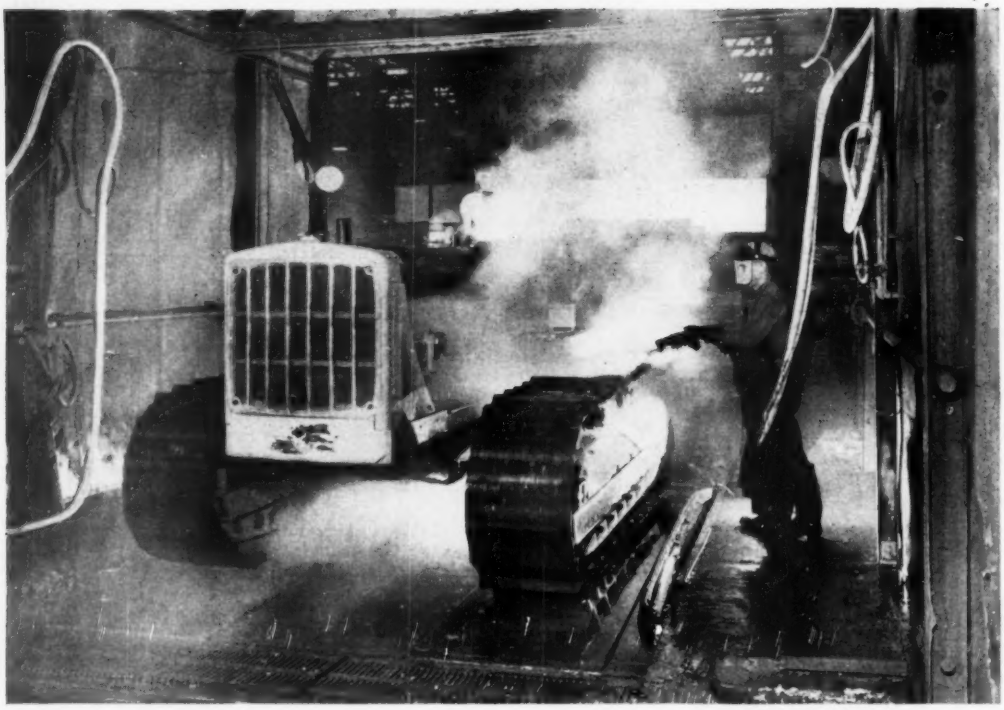


**PRECIPITATOR** The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity. It can also be used to reduce silica.

**Consult Permutit without obligation on any of these processes. Our know-how in water conditioning, backed by 35 years experience, can provide the answer to any water treatment problem. Write to The Permutit Company, Dept. P-11, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., Montreal.**

Permutit

**Water Conditioning Headquarters For Over 35 Years**



*Courtesy of Caterpillar Tractor Co.*

# Republic Steams "Caterpillar" Diesels

## *. . . Republic Hose is used in every industry*

Tough "Caterpillar" Diesel Tractors are perfectly groomed.

Each one is blasted by steam before the final protective paint dresses them up and protects their hides. Republic's Steam Hose is used for this cleaning job, and Caterpillar Tractor Co. has found Republic Rubber's E-101 Steam Hose to be highly satisfactory in maintaining the production schedule of its products.

"I am not surprised," says Mr. John H. Flora, president of Hagerty Brothers Company, the Republic Distributor in Peoria, Illinois. He knows that Republic Rubber Products are built ruggedly, and it just seems natural to him that these tough tractors should be serviced by Republic's sturdy E-101 Hose.

The body of Republic Steam Hose is constructed with plies of strong, insulated hard-woven duck which is applied on a bias for maximum pressure resistance and flexibility. The thick heat-resisting tube retains its flexibility under severest conditions. A tough, abrasion-resistant cover protects the hose from service wear and unusual punishment.

Republic, 47 years experienced, serves all industries and is qualified to aid *you* in any problem concerning Mechanical Rubber Goods.

Look in the classified section of your telephone directory for your local Republic Distributor's name, or write direct.

*Mr. John H. Flora, Pres. & Treas. Hagerty Brothers Company Peoria, Illinois*

★

*Pioneers in the use of COLD RUBBER*

**REPUBLIC RUBBER DIVISION**

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN, OHIO

Lee Deluxe Tires & Tubes · · Conshohocken, Pa.

MECHANICAL RUBBER GOODS BY

**REPUBLIC RUBBER DIVISION**

# Announcing New GOULDS Stainless Steel Pumps...

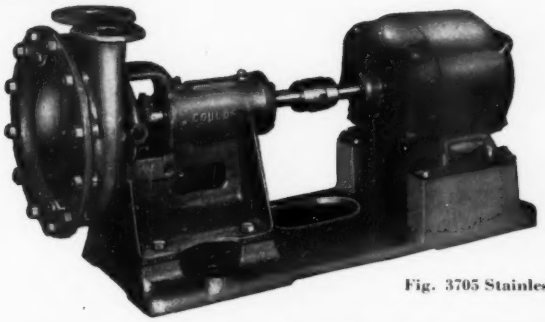


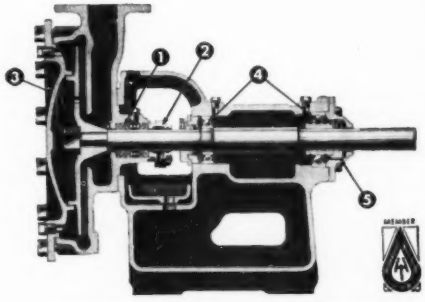
Fig. 3705 Stainless Steel Centrifugal

## For outstanding service in handling corrosive liquids —*Goulds Stainless Steel Centrifugals*

**Goulds Fig. 3705 Stainless Steel Centrifugals represent the last word in advanced pump design. They will give efficient, dependable service in handling corrosive liquids—at low cost.**

**CAPACITIES** Made in 8 sizes to handle up to 750 G. P. M. with heads to 180 ft. depending on capacity.

## Outstanding Economy in Design and Performance




### CHECK THESE FEATURES

1. Stuffing box under suction pressure only—This assures long packing life and freedom from excessive leakage.
2. Cowl type stuffing box gland split on 45° angle—Easy to disassemble. Single and double mechanical seals also available.
3. Piping connections in casing—You can inspect or clean pump by removing case cover without disturbing connections. You may also remove impeller in the same way.
4. Bearings - Prelubricated and fully protected from liquids pumped.
5. Can be adjusted for wear—If wear eventually occurs between impeller vanes and casing, you can adjust clearance using outboard bearing locking collar.

See this pump on display at our exhibit at the 22nd Exposition Chemical Industries, Grand Central Palace, New York, from November 28th to December 3rd. Booth 625.

***For complete information on this advance design Stainless Steel Pump send coupon for FREE Bulletin.***

Goulds PUMPS INC. Seneca Falls New York

GOULDS PUMPS INC., Dept. PO, Seneca Falls, N. Y.

Please send your FREE Bulletins . . . to:

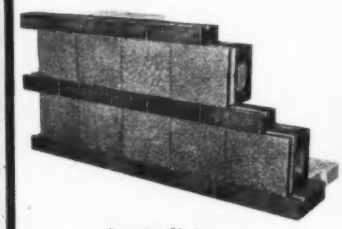
Name _____

Company _____

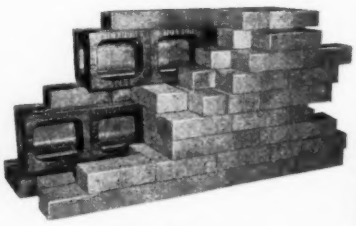
Street _____

City _____ State _____

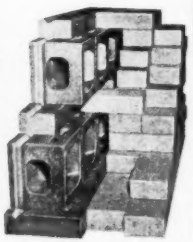
# CRYSTOLON *Air Cooled* BLOCKS
## for *Air Cooled* Walls in Boiler Furnaces



Crystolon Blocks
and Special 9" Brick Fire Face View



Rear View
Showing Hollow Block Design



End View
Showing Air Passage

### CRYSTOLON

Crystolon is the Norton Company trade-mark for products made of silicon carbide. A maximum of highest quality silicon carbide and a minimum of refractory bond are used in Crystolon hollow blocks and bricks for boiler furnaces.

Reduced boiler lining costs and economies of operation can be the benefits to you of ordering Crystolon hollow blocks. These blocks are specially designed for the scientific construction of air cooled walls in boiler furnaces. They possess four important qualities:

(1) *Unusually high refractoriness* permits the use of these blocks up to 2900 F.

(2) *Resistance to slag action* is accomplished by the great denseness of Crystolon blocks. Slag will not take hold by penetration.

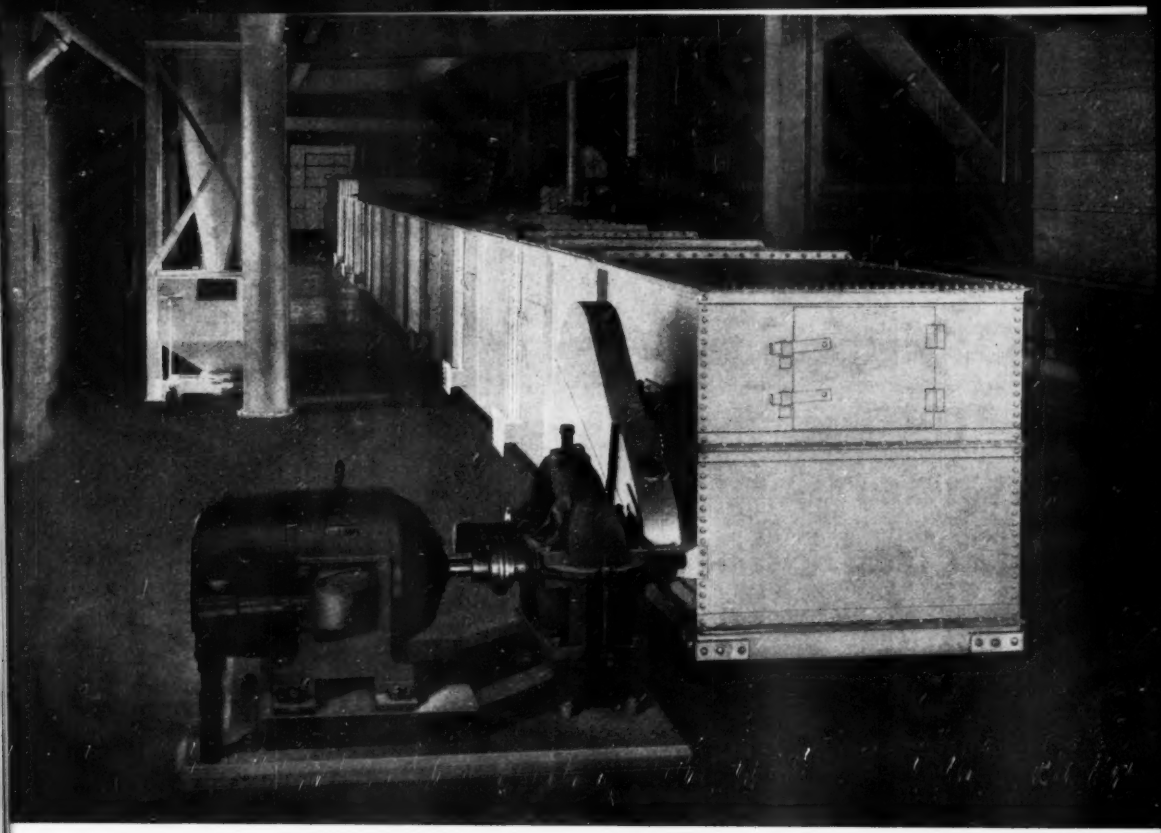
(3) *Resistance to clinker adhesion* is another feature of these blocks. What little amount that does adhere is easily removed without any damage to the surface of the blocks.

(4) *Resistance to abrasion* is offered by Crystolon blocks which are made of one of the hardest substances known. A moving fire bed in a stoker-fired furnace will not wear these blocks.

Crystolon air cooled blocks are designed as a full block having a 9" base or as a half block with a 4½" base. The blocks are made with either a blank face or a perforated face having two or four holes.

NORTON REFRACTORIES LIKE HEAT

**NORTON COMPANY, WORCESTER 6, MASS.**



# Dust-tight coal distribution to bunkers

THE picture above, taken in the Bryce E. Morrow Station of the Consumers Power Company near Comstock, Mich., shows the equipment that distributes finely crushed dry coal to the bunkers with practically no dust loss at all.

In the housing is a Bartlett-Snow double strand flight conveyor, 80′ between centers, with 12″ x 36″ steel flights mounted on No. 678 drop forged heat treated rivetless chain. The conveyor operates at 85′ per minute, is driven with a 20 HP motor, and has capacity for about 200 tons per hour.

The fine dry coal is fed onto the flight conveyor from a belt conveyor (which is enclosed from the point at which it enters the building) and is discharged into the bunkers below through six 24″ x 30″ rack and pinion slide gates, opened and closed from the bunker floor.

An exhauster system maintains a slight suction on the bunker, the flight conveyor and the end of the belt conveyor, assuring dust free operation. The exhauster discharges into a small cyclone separator shown at the left that returns the coal dust to the bunker and discharges the air into the stack.

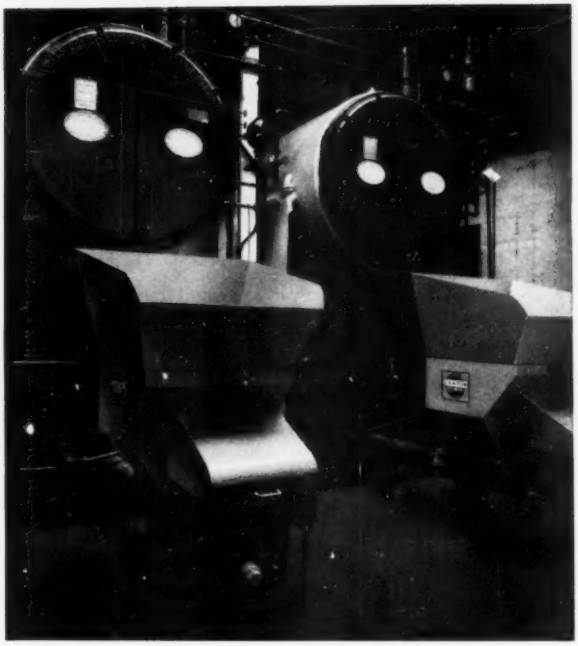
Let the Bartlett-Snow engineers with their long and exceedingly successful experience in central station coal handling, work with you on your next coal handling job. The C. O. Bartlett & Snow Company, Cleveland 5, Ohio. Engineering representatives in New York, Baltimore, Detroit and Chicago.

**BARTLETT-SNOW**
CLEVELAND 5, OHIO

**COAL HANDLING SYSTEMS**
*for*
*CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS*

# Farnsworth finds CANTON STOKERS "...save considerably on...coal bill and cost little to operate"

The letter quoted below is typical of hundreds received from operators of power and heating plants—large and small.



Two Canton Stokers furnish dependable, economical heat for Farnsworth Radio and Television Corporation.

Dear Sir:

I'm glad you asked me how I liked our Canton Stokers after several years of operation, as we have had excellent results from them. It is probably the most ruggedly built stoker of its size on the market and is safe and dependable. We find it saves considerably on our coal bill and costs little to operate.

Altogether, I am well satisfied; we feel it is one of the best purchases we ever made.

J. H. McGary
FARNSWORTH
Television and Radio Corp.

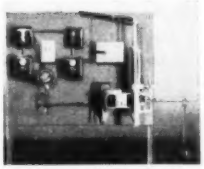
CANTON STOKERS

With high fuel and labor costs and smaller profit margins, the economies which Canton "Job-Planned" Stokers make possible are more important than ever to you.

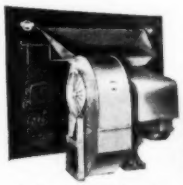
Get the facts and complete information on low-cost installation and operation. Ask your Canton Stoker representative (in principal cities) or write

**CANTON STOKER CORPORATION**
741 ANDREW PLACE S. W., CANTON, OHIO

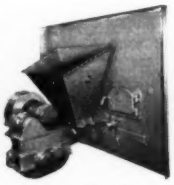
"Turbo-Aire" Jets—for smoke abatement, firing efficiency.



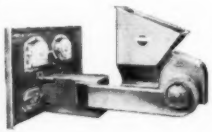
Synchronized Combustion Control Systems—for all boilers.



Vulcan Ramfeed Stokers — for loads up to 800 H.P.



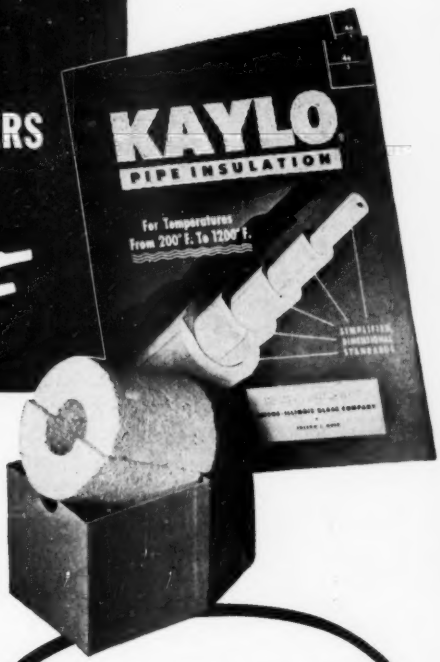
LoSet Ramfeed Stokers — for loads up to 350 H.P.



Duraflex Wormfeed Stokers — for loads up to 175 H.P.

# NOW!

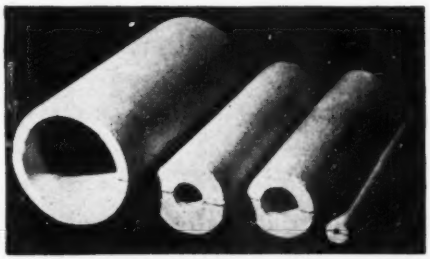
## One PIPE INSULATION COVERS TEMPERATURES FROM 200°F. to 1200°F.




# KAYLO®
## PIPE INSULATION

Here's a real advance in pipe insulation you should know about—the broad adaptability of Kaylo Pipe Insulation in serving a 1000° range of temperature requirements. To get a Kaylo Pipe Insulation sample and descriptive folder, fill in and send the coupon below. These are some of the reasons you'll be interested:

- Kaylo Pipe Insulation offers remarkable efficiency from 200° up through 1200°. It withstands effects of vapor and water.
- Simplified Dimensional Standards of thicknesses and diameters allow snug-fitting nesting of successive layers, when necessary—simplify installation and permit minimum inventories.
- Easy to handle and apply, this strong, lightweight insulation can be cut, scored and sawed with standard tools.
- The experiences of varied industries with millions of feet of Kaylo Pipe Insulation attest to its wide-range efficiency and long service capacity.



Kaylo Pipe Insulation is available in nominal thicknesses from 1 to 3 inches in 36-in. sections, for pipe sizes from ½ inch to 12 inches. Kaylo Insulation is also available in block and lagging form.

## MAIL COUPON FOR KAYLO PIPE INSULATION SAMPLE AND DESCRIPTIVE FOLDER

This new folder tells you all about Kaylo Pipe Insulation—the available sizes and recommended thicknesses for various temperatures; physical characteristics; efficiencies, and heat losses.

**OWENS-ILLINOIS GLASS COMPANY**
**Kaylo Division** **Toledo 1, Ohio**

**SALES OFFICES AT:**

| | | |
|---|---|---|
| Atlanta | Cincinnati | Philadelphia |
| Boston | Dallas | St. Louis |
| Buffalo | Minneapolis | Toledo |
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**Owens-Illinois Glass Company — Kaylo Division**
**Dept. F-436, Toledo 1, Ohio**

Gentlemen: Please send me a Kaylo Pipe Insulation sample and descriptive folder.

NAME.....

FIRM.....

ADDRESS.....

CITY.....STATE.....

# Common troubles licked here!

HERE is a Darling Gate Valve designed to relieve you of the most common valve troubles. There are a number of contributing features, but let's take only two . . .

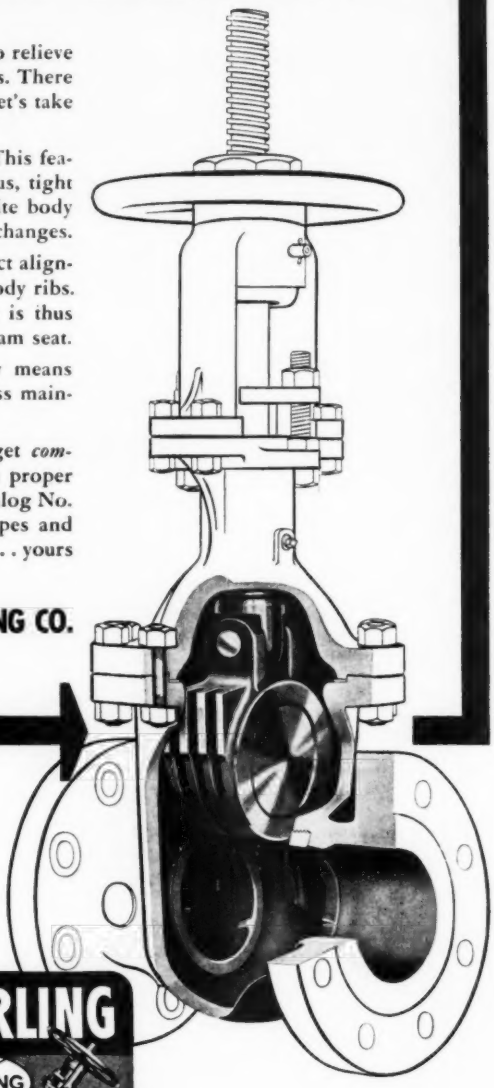
First, note the center slot in the wedge. This feature allows compression of the wedge. Thus, tight closing and easy opening are assured despite body expansion or contraction due to temperature changes.

Secondly, wedge travel is guided for perfect alignment by *double* wedge grooves and *twin* body ribs. Canting of wedge caused by line pressure is thus eliminated, preventing damage to downstream seat.

Here's a combination that just naturally means more reliable operation . . . less trouble, less maintenance, less cost!

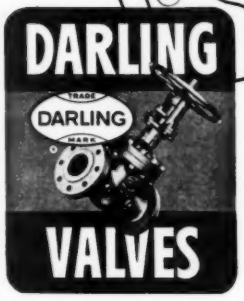
Outline your service requirements and get *complete* information on Darling Valves of the proper type. Or, send for the 300-page Darling Catalog No. 17M. It describes Darling Valves of all types and sizes . . . and is full of data of general value . . . yours for the asking.

**DARLING VALVE & MANUFACTURING CO.**
WILLIAMSPORT 8, PA.

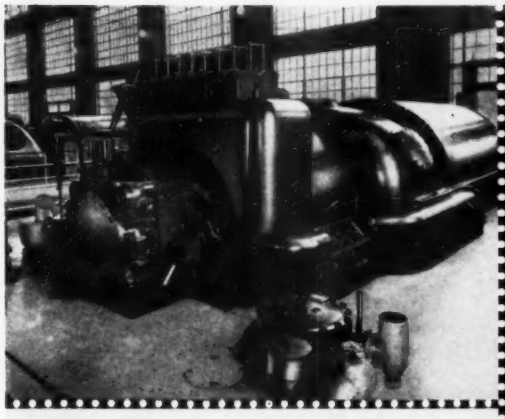
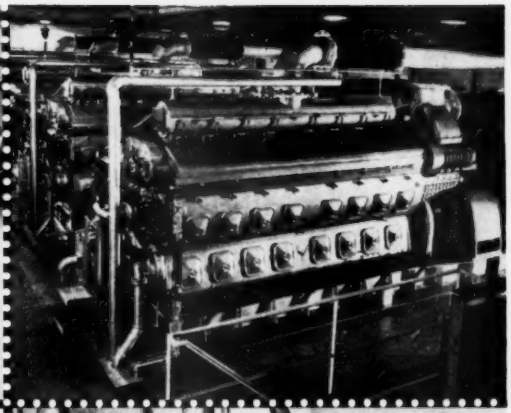


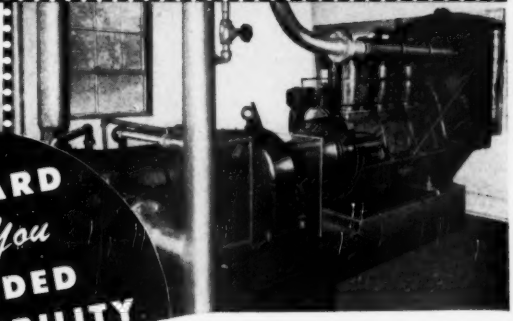
**Darling**
*Slotted Wedge*
**Cast steel gate valves**

**Darling Gate Valves, noted for outstanding quality, strength and precision, are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds. In addition to the *Slotted* wedge types, there are solid wedge taper seat valves and the famous Darling Fully Revolving Double Disc Parallel Seat Gate Valves for virtually any service.**




**THE VALVE MARK OF QUALITY... WATCH FOR IT**



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*includes . . .*

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Your inquiry is invited.

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FIVE FIELDS — Serving the CHEMICAL, POWER, PETROLEUM and GAS industries as well as providing specialized EQUIPMENT for all industries.

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POWER DIVISION

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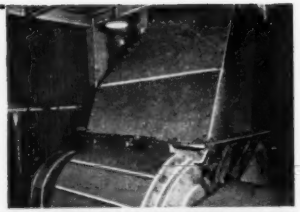
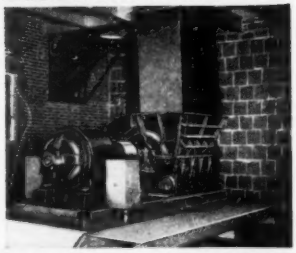
908 GRAND AVE. • KANSAS CITY 6, MO.

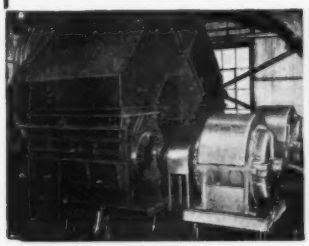
HOUSTON • NEW YORK
ST LOUIS • TULSA • LOS ANGELES • PITTSBURGH • CHICAGO

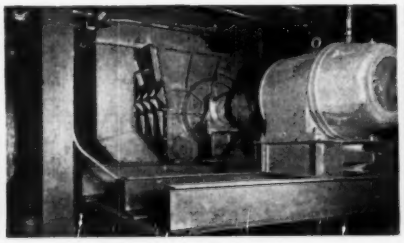
# A COMPLETE COAL CRUSHING OPERATION in less than 12′ x 12′ x 12′

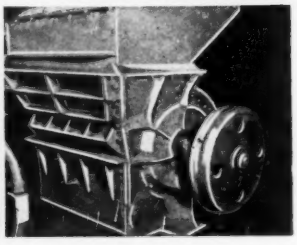
***American Rolling Ring Crushers provide high tonnage reduction with controlled uniform sizing***



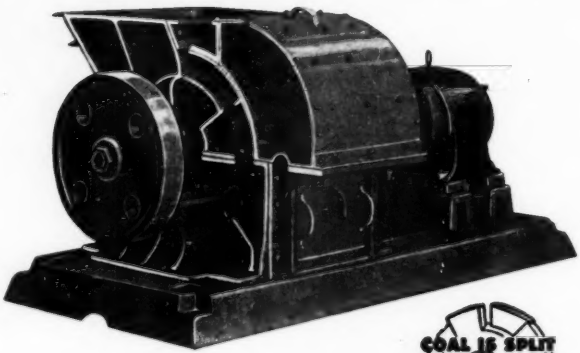








Americans are contributing to greater firing efficiency in power plants everywhere. ROM coal is rapidly reduced to stoker or pulverizing sizes in one low-cost operation. A complete, compact crushing operation requiring only minimum headroom and no auxiliary crushing or breaking units, Americans incur little or no extensive plant alterations. American Rolling Ring Crushers are built in capacities up to 500 TPH.



Only Americans offer the patented shredder ring action that *splits coal* by efficient cleavage action of multiple cutting edges.

COAL IS SPLIT - NOT CRUSHED

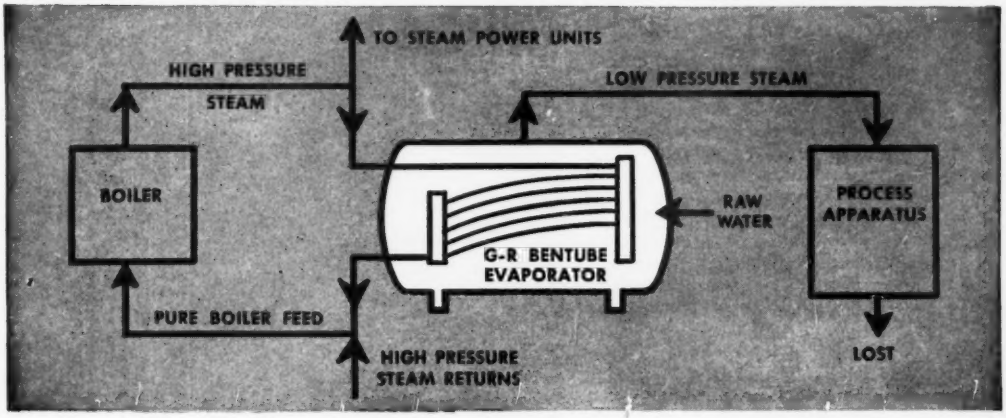
***Get the data on improved coal preparation— Send for Americans "S" Crusher Bulletin.***

**American PULVERIZER COMPANY**

*Originators and Manufacturers of Ring Crushers and Pulverizers*

**1349 MACKLIND AVE.**
**ST. LOUIS 10, MO.**

# HOW you can obtain PROCESS STEAM efficiently



Bulletin 366 explains the various methods of associating evaporators with the plant heat balance and describes in detail the designs and special features of G-R Evaporators. Write for your copy.

**THE GRISCOM-RUSSELL CO.**
**285 MADISON AVENUE, NEW YORK 17, N. Y.**

A G-R Bentube Evaporator uses steam from high pressure sources to produce lower pressure steam for process work. The high pressure steam which operates the evaporator is all returned to the boiler, after use, in the form of condensate. Therefore, no raw, scale-forming make-up or contaminated drains from steam used in process is fed to the boiler, thus reducing boiler maintenance.

Raw untreated water can be fed to the evaporator producing the process steam. G-R Bentube elements of scale-shedding design make possible the use of raw water because they maintain rated heat transfer without requiring hand scaling.

The G-R Bentube Evaporator used in this service operates as a practically 100% thermally efficient reducing valve, and ideal plant heat balance can be arranged.

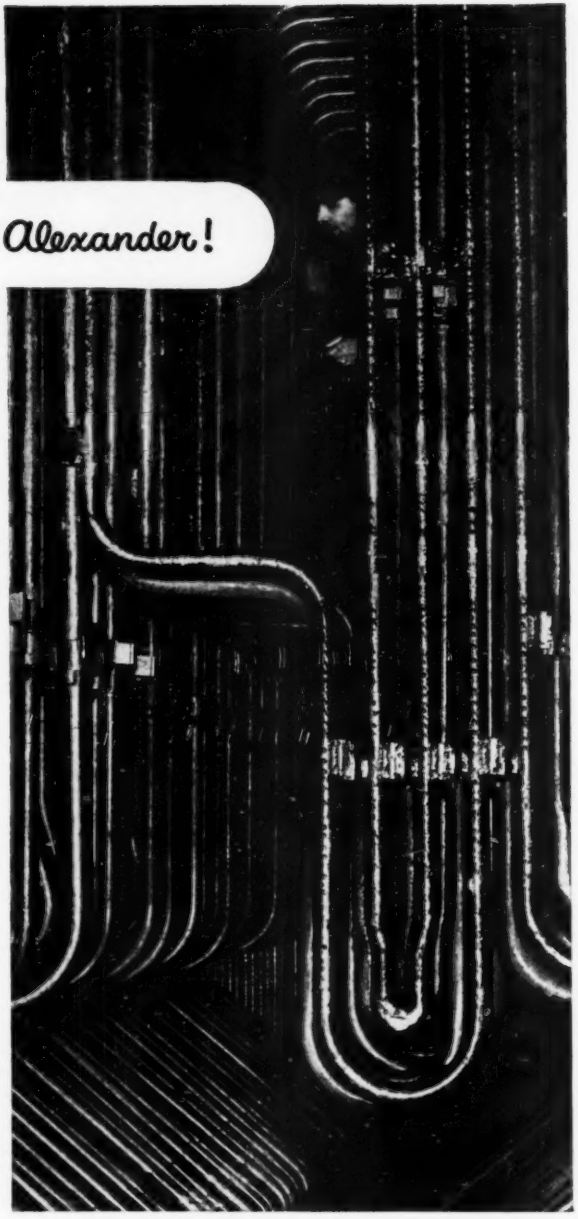
Many millions of pounds per hour of process steam are now being produced in highly successful G-R Bentube Reducing Valve Evaporator plants. Investigate this economical method of obtaining process steam for your plant.

GR-196

**GRISCOM-RUSSELL**

*Pioneers in Heat Transfer Apparatus*

# Take a gander at Mr. Alexander!



HERE'S a candid camera shot of the gentleman making a grand tour of the reheater elements of one of the highest pressure, large utility boilers in the country.

If you look closely you'll see that Mr. A. appears rather pleased. And, why not? That stack of tubes he's giving a final once-over is all set for a long term of trouble-free performance because they're all NATIONAL Seamless —none better for handling extreme temperatures, high pressures or complicated assemblies like this.

Do you know why so many public utilities have standardized on NATIONAL Seamless Boiler Tubes—why you'll find them preferred in high pressure steam plants of all kinds — why NATIONAL Seamless stands for safety, security, and dependability wherever used?

It's because NATIONAL Seamless Tubes are *pierced from solid billets of steel* . . . are made by the only process that absolutely removes all uncertainty regarding uniform wall strength.

What is equally important, these superior tubes—these original "Walls Without Welds" —that power plant engineers have confidently put their trust in for the past sixty years, have been continually improved. Constant advancement in tubular metallurgy and fabrication assures dependability and economical operation under today's increasingly heavier loads—and incidentally, makes them the easiest tubes to work with.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
(TUBING SPECIALTIES DIVISION)
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

**NATIONAL** Seamless
**BOILER TUBES**

UNITED STATES STEEL

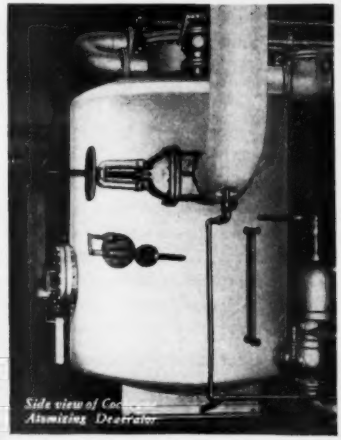
AT GULF STATES PAPER CORPORATION, Tuscaloosa, Alabama, a Cochrane Atomizing Deaerator of 175,000 lb/hr delivers water of "zero oxygen" content, using water of 50°F. at 50 psi from a storage tank. This is one more of the many Cochrane deaerators in use in the great paper industry. • These deaerators are of many types and sizes; of cast iron with caulked joints, or of steel rolled plate construction. They include the familiar tray type, or, like this one at Gulf States, the atomizing type, both of which have their advantages, depending on conditions. Either can be designed to give complete oxygen removal ("zero oxygen") under the same conditions. • Cochrane, manufacturers of tray type, jet-tray type or atomizing type, can advise with authority on the type best suited to your particular problem.

COCHRANE CORPORATION
3106 N. 17th Street, Philadelphia 32, Pa.

"ZERO OXYGEN"
at GULF STATES PAPER CO

COCHRANE

*Inquiries will be welcomed. Publication 4160, "Cochrane Atomizing Deaerators", is a clear, unbiased discussion of the advantages of the atomizing deaerator. Publication 3005 discusses all types of Deaerators with particular emphasis on the tray type. Ask for either or both.*



*Side view of Cochrane Atomizing Deaerator*

# *All These Were Once*

# DUST COLLECTION PROBLEMS, TOO

*48 Carbon Black Plants*

*203 Metallurgical Installations*

*205 Acid Plants*

*40 Paper Mills*

*270 Detarring Installations*

*216 Power Stations*

*73 Steel Plants*

*99 Oil Refineries and Miscellaneous Installations*

**Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blue prints.**

**This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems*.**

**In hundreds of power plants today, Research Corporation Cottrells are collecting 90% to over 99% of fly ash from pulverized fuel boilers. Write for your free copy of an informative booklet giving valuable data on these installations.** RC-116

## *Typical One Day Collections:*

**250 TONS OF FLY ASH • 6 TONS OF SODA SALTS AT A PAPER MILL • 25 TONS OF SODIUM SULPHATE AT A KRAFT MILL • 6 TONS OF BLAST FURNACE DUST**

**RESEARCH CORPORATION**

*405 Lexington Avenue, New York 17, N. Y.*
*122 South Michigan Avenue, Chicago 3, Illinois*

# Now...You can save

**UP TO $25 PER PANEL**

***On Radiant Heating Installations***

*With the New...*

## HOMESTEAD Radiantrol VALVE

THE COMBINATION BALANCING VALVE AND AIR VENT FOR RADIANT HEATING SYSTEMS

### *Check These Features*

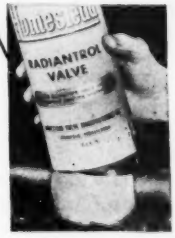
- Regulates hot water flow to each panel.
- Balances heat between panels to meet varying requirements.
- Fits flush with floor eliminating unsightly vent pipes or protruding controls.
- A quarter-turn of toe-plate cover fully opens or closes.
- Graduations between open and closed positions give instant choice of amount of hot water for each panel.
- In open position valve provides nearly full pipe area flow.
- Chamber in neck of valve body especially designed to collect trapped air without restricting flow.
- Vent screw on valve cap provides simple means of removing trapped air from system.

The new Homestead Radiantrol Valve performs the same function for each radiant heating panel that a manual valve does on a radiator. It controls the flow of hot water to each panel or room and balances heat between the various panels. It is simply designed, easy to operate, and can be quickly and economically installed.

By eliminating the cost of making special valve "wells" and covers, and separate riser air vents, *savings up to $25.00 per panel installation* may be realized.

Available in 1", ¾", ½" and ¼" sizes with floor plate and base ring of brass, iron, or other metals, or with wheel handle and indicator for wall installation.

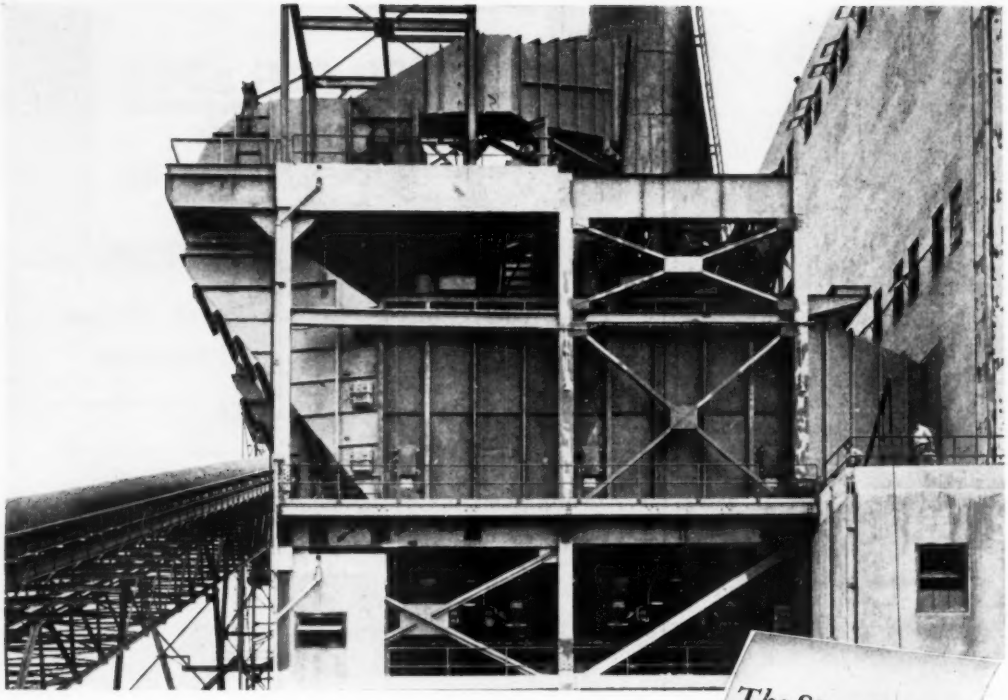
For complete data write for reference book No. 39, Section 7.




**Unique Money-Saving Carton becomes an inexpensive mold for concrete valve well, effecting savings up to $25 per Panel Installation.**

**HOMESTEAD VALVE MFG. CO.**

P. O. BOX 210 CORAOPOLIS, PA.



*The Story Behind*
**KOPPERS-ELEX**
*Performance*
**GUARANTEE**

# How to get MAXIMUM Nuisance Abatement!

KOPPERS-ELEX electrostatic precipitators, like those in this installation, provide maximum *guaranteed* nuisance abatement . . . and improve public relations by helping make your community clean and healthy.

Although fly ash emitted to the atmosphere may vary from 0.75 to 0.25 grains per cubic foot under municipal ordinances . . . these results do not provide nuisance abatement that meets public demand. But Koppers-Elex can limit residuals to *.15 grains or less*, uniformly emitted . . . a *guaranteed* performance which protects your interests *now and in the future* by providing maximum nuisance abatement under all conditions!

Koppers-Elex precipitators assure you of *maximum efficiency* and *performance as guaranteed* . . . results of the experience gained in over 1000 successful applications. So, for superior recovery or removal of material from industrial gases, specify Koppers-Elex . . . *designed, engineered, built, installed and guaranteed* by Koppers . . . *with 111 years of reputation-building integrity behind it*. Koppers Co., Koppers-Elex Precipitator Dept., 231 Scott St., Baltimore 3, Maryland.

**1st with Industrial Gas Cleaning Equipment**

*Koppers-Elex*
**ELECTROSTATIC PRECIPITATOR**

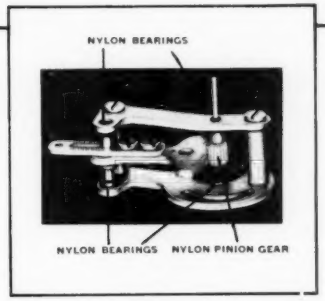
KOPPERS

# *Every Engineer should read this!*

THE TREND in gauge movement design over the years has been in the direction of increased bearing diameters and lengths, width of tooth engagement, hardness of wearing surfaces, and mass of parts in order to achieve *greater wear resistance.*

But in increasing the mass of parts, accuracy and sensitivity are invariably impaired and wear resistance is not necessarily improved. The high impact effect at bearing and other wearing points, which is related to the natural weight of the metal used, *creates wear!* The "products of wear" increase the rate of wear and when carbon particles are exposed, they rust.

The ideal conception of a gauge movement should, therefore, incorporate lightness in parts which move to enhance sensitivity and accuracy of indication and to lessen impact effects on severe service. The "products of wear" should not cause increased wear or be susceptible to atmospheric corrosion. The materials used at bearing and other wearing points should absorb or soften impact. Adequate strength and general corrosive resistance must be provided.




The Ashcroft Duragauge Nylon-Aluminum Movement* is a break with tradition, a completely new and revolutionary approach to movement design. It meets fully all these requirements!

The nylon parts provide impact absorption, retention of accurate form shape under sufficiently high temperature, no objectionable wear products (should any form), low friction and adequate corrosion resistance.

Aluminum contributes lightness in the mating parts which reduces potential impact to its lowest terms and increases sensitivity. The anodized surfaces enhance the low frictional properties of the aluminum. In contact, the aluminum tends to glaze the nylon which increases the wear resistance and lowers the coefficient of friction. The general corrosive resistance of aluminum is very good. And even in the case of such chemicals as methyl chloride and methyl bromide, which should not be used in direct contact with aluminum base alloys, the Nylon-Aluminum Movement in the Duragauge Vapor Proof case stood up well.

In laboratory and field tests on the worst pulsating services to be found, the Duragauge Nylon Movement outwore all other movements of whatever material or design.

In installations on "killing" services in refineries, chemical plants and power stations, the Nylon Movement showed its inherent superiorities.

We invite your inquiries concerning this new Ashcroft Duragauge movement.

**Pat. Applied For*

*Stocked and sold by leading distributors everywhere*

MAXWELL MANNING M&M MOORE INC TRADE MARK

# ASHCROFT *Gauges*

*A Product of*

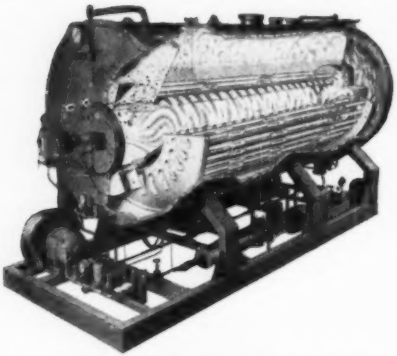
MANNING, MAXWELL & MOORE, INC.

STRATFORD, CONNECTICUT

1850 ASHCROFT U.S.A.

Makers of 'Ashcroft' Gauges, 'Hancock' Valves, 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load Lifter' Hoists and other lifting specialties.

*THIS airliner's streamlined for speed*



# This AMESTEAM is GENERATOR Streamlined for Saving

This cut-away view of an AMESTEAM Generator shows the three full-length-of-boiler passes arranged to provide a smooth, even flow of gases through the Unit — insuring more efficient conversion of your fuel BTU's into steam, with resultant low stack temperatures, high $CO_2$ and a guaranteed thermal efficiency of 80%.

And it's fast, too — full steam pressure in 20 to 30 minutes.

Buy an AMESTEAM Generator — substitute its consistently smooth daily operation for your present inefficient boiler room conditions.

AMESTEAM Generators are available from 10 h.p. to 400 h.p.; for pressures from 15 lbs. to 200 lbs.; and for firing with Light Oil, Heavy Oil, Straight Gas, Light Oil-Gas or Heavy Oil-Gas Combinations. For full information —

**AMES IRON WORKS**

Oswego, N. Y.

Builders of Better Boilers Since 1848

SEND IN COUPON *Today*

AMES IRON WORKS

Box 811, Oswego, N. Y.

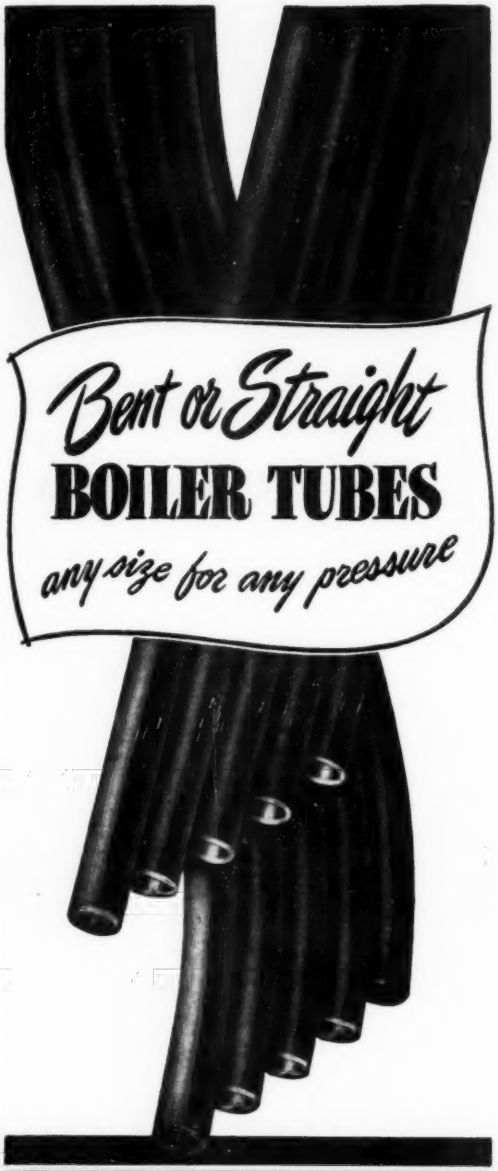
I would like to know more about Amesteam Generators. Please send your latest bulletin.

Name.....

Company.....

Address.....

City..... Zone..... State.....



*Bent or Straight*

**BOILER TUBES**

*any size for any pressure*

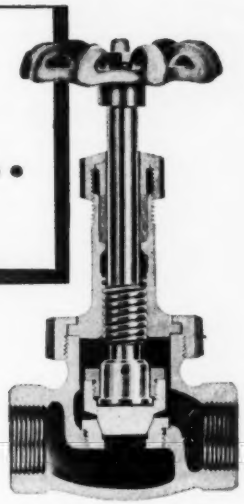
**BOILER TUBE CO. OF AMERICA**

McKEES ROCKS, PA. (Pittsburgh District)

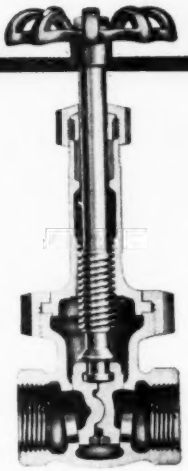
PITTSBURGH • CHICAGO

FRED S. RENAULD & CO., LOS ANGELES

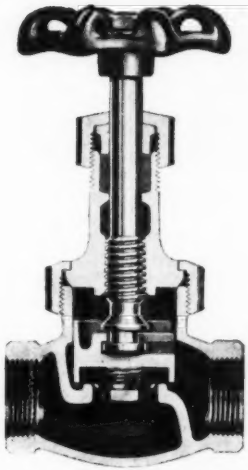
# Walworth bronze valves...



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc



Walworth
No. 29 Gate Valve



Walworth No. 95 Globe Valve
Re-New-Disc

## built to give dependable trouble-free service on all recommended jobs

Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development—saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bonnets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

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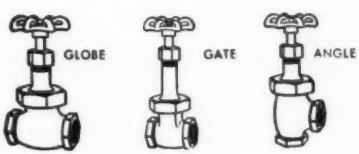


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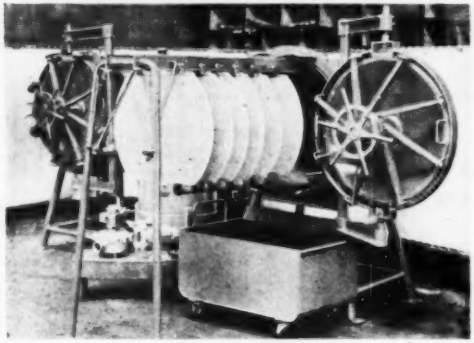

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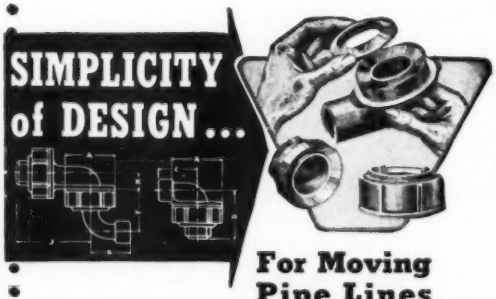

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## Cleaning and Care of Copper Alloy Condenser Tubes

Primary reasons for keeping condenser and heat exchanger tubes clean are to maintain the efficiency of the unit at a high level and to prolong tube life. Numerous cleaning methods are in use today which depend upon the nature of the material to be removed from the tubes or tube surfaces. The application of these methods varies considerably from plant to plant.

**A. Manual or mechanical** methods for removal of silt, slime, debris and large fouling organisms.
1. Hand removal of debris and "rodding"
2. "Shooting" rubber plugs, brushes and scrapers
3. Jetting with water or water-air or water sand
4. Drying with hot air

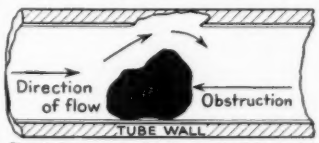
**B. Control of fouling or deposits**
1. Screening
2. Chlorination
3. Increasing water velocity
4. Heating the water
5. Changing salinity of the water
6. Lowering the oxygen content of the water
7. Poisoning with various poisons

**C. Methods of scale removal**
1. Inhibited acids
2. Bases
3. Flexing of tubes
4. Thermal shocking

### Manual Methods of Cleaning

The manual methods of cleaning condenser tubes are necessary in removing pieces of debris such as wood, coke, shells, refuse and masses of foliage or sea weed which have found their way past screen bars, stationary and rotating screens. Jetting of the tubes with water or water and air frequently dislodges much debris caught in the tubes. The shooting of rubber plugs, etc., will remove much slime, silt, etc. The jetting of tubes with a mixture of water and sand will remove slime, compacted silt, scale and layers of corrosion products. The manual method may or may not be supplemented by other methods.

In some stations it is necessary to manually clean the condensers daily. The debris is removed from the water boxes and picked from the tube sheets and tubes entrances. In other stations located in harbors, the condensers are manually cleaned each week. Then, again in certain areas, it is only necessary to manually clean the condensers during certain seasons of the year when large amounts of foliage, nuts, fruits, etc., may make it necessary to clean the condensers daily or twice daily until the critical period is passed. Occasionally it is necessary to "rod" the tubes in order to remove debris or shells stuck in the tubes. It is recognized that this is dangerous since the rod end may gouge the tube. After removal of debris, the tubes are often jetted in counterflow direction with compressed air and water.




Sketch shows result of a deposit of solid material deflecting water against the tube wall.

Some stations regularly "shoot" rubber plugs through the condenser tubes with water at 125 pounds pressure after removal of the debris by hand picking and jetting. This method of cleaning the tubes has one chief limitation in that it is frequently very difficult to "shoot" more than 2000 tubes per day. Various shapes of rubber plugs have been used, one type consisting of a solid plug of rubber, another one is shaped somewhat like a dumbbell. It is claimed that the latter plug has an advantage since there are two scraping edges for contact with the tube surface.

Scrapers made of various designs and materials have been used. Some of these scrapers rotate as they travel down through the tube. In some stations the operators prefer the use of various brushes instead of rubber plugs for cleaning the tubes. The bristles of these

Result of deposit which deflected stream against wall of cupro nickel tube, showing even highly corrosion resistant materials are damaged. Mag. 2x

brushes have been made of such materials as steel, brass, fibre and nylon. There appears to be a place for each of these types of brushes, depending upon the nature of the deposit forming on the tube surfaces. Occasionally, an objection is raised to the use of steel bristle brushes and scrapers since they may scratch or cut the tube surface. Some of the newer bristle brushes and scrapers may overcome the past objections to this type of cleaning. Electric or air motor driven brushes are generally used to clean condenser tubes.

### Effect of Sand

In some areas there is sufficient sand in suspension in the cooling water to keep the condenser tube remarkably clean. The life obtained under these conditions varies considerably. In some plants 10 to 20 years' life have been obtained from Admiralty tubes handling water containing suspended sand. On the other hand, instances have been reported where corrosive wear has reduced the wall thickness to paper thickness in a very short time. Because of the good cleansing action of water containing sand, a few plants have devices to introduce sand into the water jet. The amount of sand is varied according to the scale to be removed. If too much sand is used, protective films can be completely removed from the tube surface and bare metal exposed.

In subsequent issues we will deal with the control of fouling and methods of scale removal from condenser tubes. For technical information on condenser and heat exchanger tube alloys and their applications, write for Bridgeport Condenser Tube Manual.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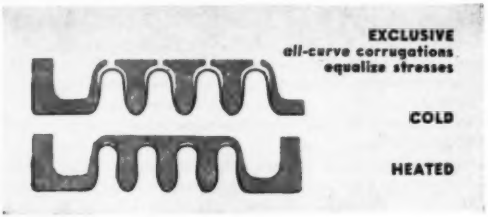


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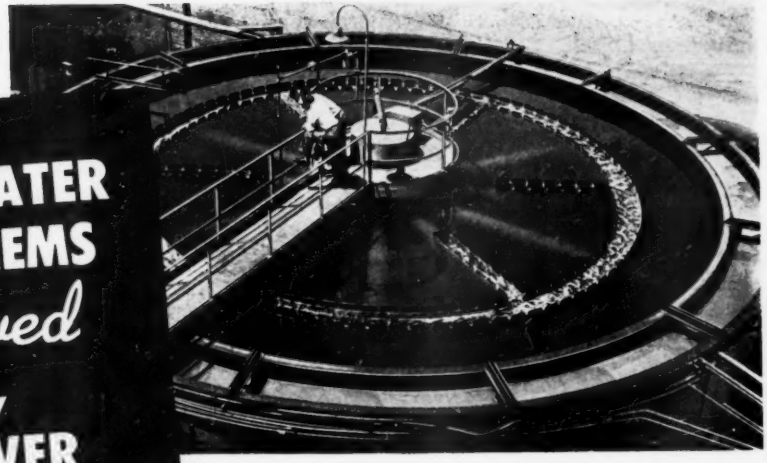

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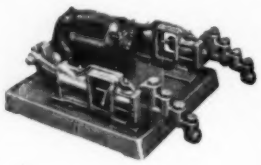

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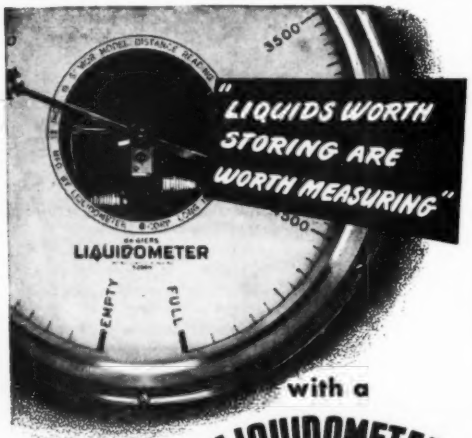


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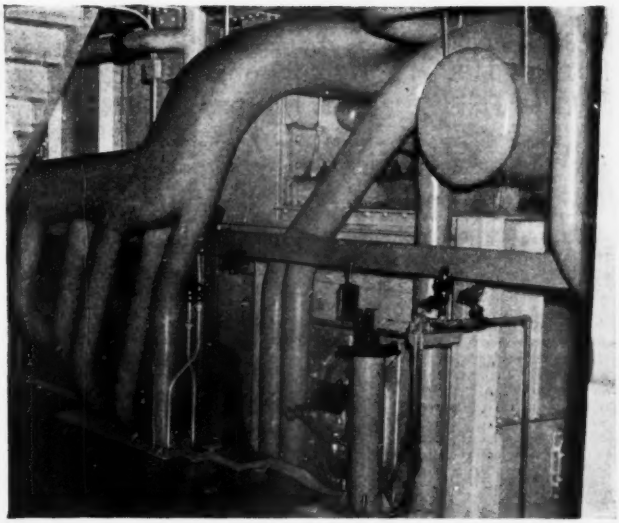

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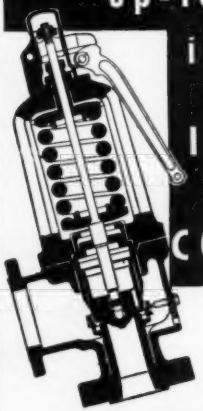

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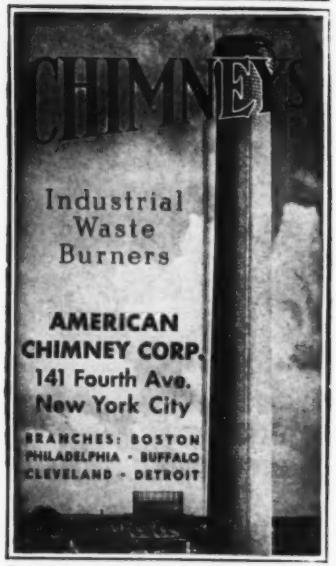

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INDUSTRIALS
● They increase efficiency, capacity, economy—decrease slippage, leakage, fuel consumption—will not sink in seat ports, warp, break, curl, or ride seat bridges. For hot or cold water service . . . thoroughly dependable.
BIRCH MANUFACTURING CO.
1521 Sedgwick St., Chicago, Ill.

**HILL PUMP VALVES**
SINCE 1909

● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate.
*Write for Bulletin*
HILL PUMP VALVE CO.
2728 Elston Ave., Chicago 47, Ill.

**ERNST Liquid Level Gages**
● Sight Flow Indicators
● Gage Glasses ● Try Cocks
● Gage Glass Washers
WRITE FOR BULLETIN
ERNST WATER COLUMN & GAGE CO
LIVINGSTON, N. J.

**PRINTED CELLOPHANE**
Colorful - Self Adhesive - Cellophane, processed in Rolls. Easy to buy - Easy to apply - used for Packaging - Point of Sale advertising - Parts marking and Aircraft Wire terminal identification.
TOPFLIGHT TAPE - YORK, PA.


# PROFESSIONAL SERVICES

CONSULTING DESIGN EXAMINATIONS PATENTS
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**ASSOCIATED ENGINEERS, INC.**
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*Consulting Engineers*
Design & Construction Specialists
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**REYNOLDS, SMITH AND HILLS**
*Engineering Consultants*
Specialists in Design and Construction of Industrial and Central Station Plants
Reports, Analyses and Surveys
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**BROWN ENGINEERING CO.**
*Consulting Engineers*
Power Plants, Substations, Transmission.
Water Supply, Sewage Disposal, Rates
K. P. Building Des Moines 9, Iowa

**SANDERSON & PORTER**
*Engineers and Constructors*
New York Chicago
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**BURNS & McDONNELL ENGINEERING COMPANY**
*Consulting Engineers — 50th Year*
Power Plants - Steam - Diesel - Hydro
Electric Systems - Rate Reports - Valuations
Water and Sewer Systems and Treatment
Box 7088, Country Club Station,
Kansas City 3, Missouri

**SARGENT & LUNDY**
*Engineers*
140 South Dearborn St. Chicago, Illinois

**ENGINEERING SERVICE COMPANY**
*A Complete Service For Industry*
Electrical Mechanical
Design, Drafting, Ink Tracing, Maps
Plans, Charts
Manufacturers, Tools, Dies, Mechanical and Electrical Equipment.
624 South Michigan Ave. Chicago 5, Illinois
HArrison 7-7024

**J. E. SIRRINE COMPANY**
*Engineers*
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Design Reports
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**GILBERT ASSOCIATES, INC.**
*Engineers and Consultants*
Industrials and Utilities, Power Plant Design and Construction. Rehabilitation and Maintenance.
Steam — Diesel — Hydro — Sewage
Reports — Examinations — Laboratory
New York Reading, Pa. Philadelphia
Houston Washington

**STANLEY ENGINEERING COMPANY**
*Consulting Engineers*
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Hershey Building Muscatine, Ia.

**THE KULJIAN CORPORATION**
*Engineers - Constructors*
Power Plants and Industrial Projects
1200 N. Broad St., Philadelphia 21, Pa.
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**JOHN A. STEVENS, INC.**
Established 1908
*Consulting Engineers*
Power Plants Paper Mills
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*Engineers*
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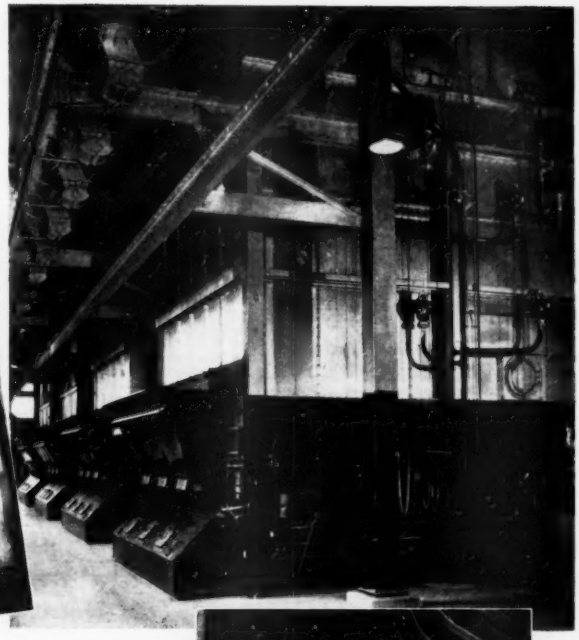
**SYSKA & HENNESSY, INC.**
*Engineers*
Consultation Plans Reports
Power Plants Disposal Plants
Water Systems
144 East 39th Street
New York, New York

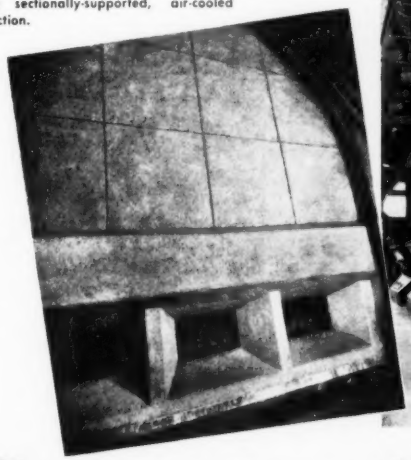
**PIONEER SERVICE & ENGINEERING CO**
Consulting and Design
Engineers . . Purchasing . .
Specialists in Financing,
Accounting and Other Operations
231 So. La Salle St. Chicago 4

**THE J. G. WHITE ENGINEERING CORPORATION**
Design-Construction-Reports-Appraisals
80 Broad Street, New York 4

New boiler equipment installed at Milwaukee Shops of Chicago, Milwaukee, St. Paul & Pacific R.R. Co., Milwaukee, Wis. Four new boilers rated at 60,000 lbs. steam per hr. maximum, with Plibrico sectionally-supported, air-cooled settings. Two Bros boilers (left), two B. & W. boilers (right), all with Bros "Travl-Spred" stokers.



Furnace interior showing front wall of Plibrico sectionally-supported, air-cooled construction.



# *Modernization calls for* PLIBRICO *of Course!*

The Chicago, Milwaukee, St. Paul & Pacific R.R. has installed four new boilers as part of a modernization program at its Milwaukee Shops. These boilers, which have replaced ten smaller units, all have complete Plibrico sectionally-supported, air-cooled, steel-cased settings.

The monolithic structure of Plibrico provides complete freedom from trouble-breeding joints. Nothing less than the Plibrico idea of refractory in moist, plastic form can provide linings so perfectly and so readily shaped to every contour. And nothing less than this Plibrico construction—with a cooling lane of moving air between refractory and outside wall—can so prolong the life of both.

Whatever your boiler setting or refractory needs, remember the Plibrico way is the completely modern way. It provides finest-quality refractory materials; an engineering background that encompasses every problem in this field; advanced construction methods which also include Flexo-Anchors to prevent bulging, Taperlok supports for sectionalized construction, sturdy suspended arches, and Beco-Turner baffles.

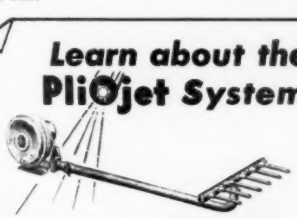
All this is available to you through your local Plibrico Sales & Service organization—part of the most complete refractory and boiler setting service in America. Write for catalog; specify water tube or H.R.T. edition, please.

**PLIBRICO JOINTLESS FIREBRICK CO.**
**1818 Kingsbury St., (Dept. K), Chicago 14, Ill.**

**PLIBRICO *Jointless* FIREBRICK**

Furnace interior showing Plibrico sectionally-supported, air-cooled lining backing up water-cooled side wall.

## *Learn about the* Pliojet *System*



The over-fire air system for smoke abatement that introduces secondary air above the fuel bed where and when needed.

Jet air streams create turbulence in the furnace, increase combustion efficiency, overcome smoke, save fuel. Write for new bulletin and survey sheet which permit us to design a Pliojet application to suit.

# SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

**UNDISPLAYED RATE**
*(Not available for equipment advertising)*
$1.20 a line, minimum 4 lines. To figure advance payment, count 5 average words as a line.
INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of rate, payable in advance.
PROPOSALS, $1.20 a line an insertion.

**INFORMATION**
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

**DISPLAYED RATE:**
The advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns — 30 inches—to a page.

*NEW ADVERTISEMENTS received by November 9th will appear in the December issue, subject to limitation of space available.*


**MECHANICAL ENGINEERS**
For Positions of
**Project and Senior Engineers**
Steam Power Plant and/or Gas Plant Experience Preferred—Ideal Community—Close to Metropolitan Areas. Write to
MECHANICAL ENGINEER
PENNSYLVANIA POWER & LIGHT CO.
ALLENTOWN, PA.

**Draftsman, Mechanical Engineer, General**
Stoker Manufacturer in Pennsylvania wants Estimator, Designer, Draftsman. Permanent.
**P-1047, POWER**
330 W. 42 St., New York 18, N. Y.

**ELECTRICAL DESIGNERS**
ESTABLISHED BOSTON CONSULTANTS HAVE OPENINGS FOR ELECTRICAL ENGINEERS, DESIGNERS AND DRAFTSMEN WITH POWER PLANT AND INDUSTRIAL DESIGN EXPERIENCE.
P-9876, POWER
330 W. 42nd St., New York 18, N. Y.

**Engineers — Executives — Technical Men**
Salaried Positions, $4,000 to $30,000.
This Confidential service for men who desire a new connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details.
**TOMSETT ASSOCIATES**
1205-2 Berger Bldg., Pittsburgh 19, Pa.

*REPLIES (Box No.):*
*Address to office nearest you*
*NEW YORK: 330 W. 42nd St. (18)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*


## POSITIONS VACANT

WANTED: GRADUATE Engineer with wide experience in design and layout of Diesel Engine Electric Power Plants with steam plant knowledge desirable. Only experienced men of good character who are looking for a permanent connection need apply. Headquarters in City of over 50,000 in the Southwest. Full experience history, reference, and expected salary in first letter. P-9982, Power.


**WANTED**
An Exclusive Distributor Sales and Service Combustion Engineer in Baltimore, Detroit, Pittsburgh, Ohio, Buffalo, New York City, to represent an Old Established Manufacturer of Automatic Combustion and Industrial Process Controls. A complete line of Electronic, Hydraulic, Sequence and Modulating type Combustion Control Equipment for all makes of Stokers and Oil Burners. Liberal commission basis that should net an aggressive representative $15,000 to $25,000 or more annually.
**RW-9304, POWER**
520 N. Mich. Ave., Chicago 11, Ill.


## EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (39 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. ira Thayer Jennings, Dept., G, 241 Orange St., New Haven, Conn.

## POSITIONS WANTED

POWER PLANT Operating Superintendent, thirty years practical experience in construction and operation of steam electric-hydro electric and diesel electric power stations together with supervision of electrical distribution. Now employed as power plant superintendent desires to make change. Preference management operation of small city utility public utility or rural utility. Any location, best of health, finest of references. Reply stating salary offered and location to PW-1012, Power.

ELECTRICAL ENGINEER BEE recent graduate radar repair in Army three years—desires a start in test or development of power equipment. Willing to relocate. PW-1179, Power.


**FRED'K W. KAELBER CO.**
KAELBER
FIRE BRICK CONSTRUCTION
**BOILER BRICKWORK**
**BOILER ERECTION**
**NEW YORK TO CALIFORNIA**
*Refractory Linings For Gas Generators*
*Rotary Kilns, Incinerators, Furnaces*
**25-03 BORDEN AVE. LONG ISLAND CITY, NEW YORK**
**Phone: ST 6-9171**



**WANTED**
Representative for twenty years in the Chicago District wants one or two major accounts on Power Plant Equipment. Prefer Boilers, Turbines or Pumps. Straight Commission Basis — Protected territory.
**RA-1087, POWER**
520 N. Michigan Ave., Chicago 11, Ill.


## POSITION WANTED

POWER PLANT Supervisor, 40, B.S. in E.E. and M.S. Diversified experience in operation and supervision of steam and power plants. Some experience with refrigeration and water plants. Some estimating and supervision of construction. Six years in executive capacity. Desires an executive-engineer position with a utility or with an industrial plant or municipality. Midwest or west preferred. PW-1159, Power.

## LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946

(Title 39, United States Code, Section 233)

Of Power, published Monthly at New York, New York for October 1, 1949.

1. The name and address of the publisher, editor, managing editor, and business manager is: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.; Editor, F. W. Swain, 330 West 42nd Street, New York 18, N. Y.; Managing editor, L. N. Rowley, 330 West 42nd Street, New York 18, N. Y.; Business manager, N. O. Wynkoop, 330 West 42nd Street, New York 18, N. Y.

2. The owner is: McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.; Stockholders holding 1% or more of stock: Curtis W. McGraw, Executor of the Will of James H. McGraw, 330 West 42nd Street, New York 18, N. Y.; James H. McGraw, Jr., Curtis W. McGraw and Willard T. Chevalier, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw, all of 330 West 42nd Street, New York 18, N. Y.; James H. McGraw, Jr. and Curtis W. McGraw, Trustees for Catherine Osmun, 330 West 42nd Street, New York 18, N. Y.; Edwin S. Wilsey and Curtis W. McGraw, Trustees for James H. McGraw, 3rd, Madison, New Jersey; James H. McGraw, Jr., 330 West 42nd Street, New York 18, N. Y.; Curtis W. McGraw, 330 West 42nd Street, New York 18, N. Y.; Donald C. McGraw, 330 West 42nd Street, New York 18, N. Y.; Mildred W. McGraw, Madison, New Jersey; Grace W. Mehren, 526 Arenas St., La Jolla, Calif.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

McGRAW-HILL PUBLISHING COMPANY, INC.

By J. A. GERARDI, Secretary

Sworn to and subscribed before me this 20th day of September, 1949.

[SEAL] ELVA G. MASLIN
(My commission expires March 30, 1950)

# NOW -

***AGsco Shop Facilities as well as Reputation have reached from Coast to Coast***

**NEW AGSCO plant just across the bay from San Francisco**

## DIESEL ELECTRIC POWER

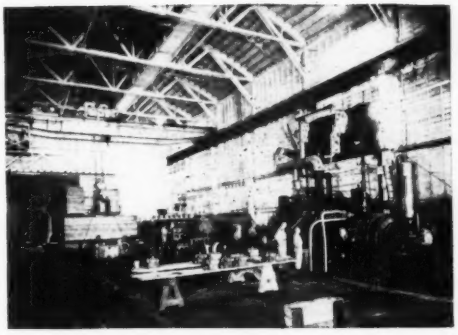
**for Immediate Delivery**

**OTHER DIESELS AVAILABLE**

**UNIT CAPACITIES—10 TO 1420 KVA**

**A.C.—50 AND 60 CYCLES**

**VARIOUS VOLTAGES**



*Interior View of AGSCO Main Shop at Sausalito (S.F.), Calif. Showing 1000 KW GMC Diesel Unit During Test Run.*

**PARTIAL LIST OF OUR INVENTORY**

| KVA | MAKE | MODEL | HP | RPM |
|---|---|---|---|---|
| 1875 | Fairbanks Morse | 33F16 | 2000 | 300 |
| 1420 | Fairbanks Morse | 38D | 1600 | 720 |
| 1250 | General Motors | 16-278A | 1600 | 720 |
| 1250 | Nelseco | 6M1-53 | 1500 | 300 |
| 1000 | General Motors | 12-278A | 1200 | 720 |
| 937.5 | General Motors | 12-567 | 1080 | 720 |
| 625 | Alco | 6-12-½x13T | 750 | 600 |
| 625 | Superior | OS | 750 | 327 |
| 425 | Baldwin | VO | 510 | 450 |
| 400 | Buckeye | 80 | 480 | 600 |
| 375 | Enterprise | DSG-6 | 450 | 450 |
| 330 | Superior | KNA | 396 | 514 |
| 312.5 | General Motors | 8-268A | 450 | 1200 |
| 312.5 | Clark | MD-4 | 375 | 327 |
| 300 | Fairbanks Morse | YVA | 360 | 257 |
| 250 | General Motors | 8-268A | 350 | 1200 |
| 200 | Buckeye | 80 | 240 | 600 |
| 187.5 | Ingersoll Rand | S | 225 | 514 |
| 125 | General Motors | 3-268A | 150 | 1200 |
| 121 | Fairbanks Morse | 32E14 | 140 | 300 |
| 75 | General Motors | 6-71 | 90 | 1200 |
| 75 | Fairbanks Morse | 35E | 90 | 450 |
| 62.5 | Int'l Harvester | UD-18 | 76 | 1200 |
| 50 | General Motors | 4-71 | 60 | 1200 |
| 25 | Hill | 4R | 31 | 1200 |

**WRITE FOR ADDITIONAL INFORMATION**

Engineered AGSCO DIESEL POWER

**A. G. SCHOONMAKER Company, Inc.**

ESTABLISHED 1898

*Diesel Engines • Power Machinery*

**52 CHURCH STREET, NEW YORK 7, N. Y. PHONE Digby 9-4350**

# GLOW ELECTRIC CO.

## SQUIRREL CAGE MOTORS

| HP | RPM | Volts | Make |
|---|---|---|---|
| 750 | 900 | 6600 | Westgh. |
| 350 | 3550 | 2200 | Westgh.-CS |
| 300 | 1800 | 440 | Al.-Ch. |
| 300 | 900 | 440 | GE-I-17 |
| 250 | 1200 | 440 | GE-KTR |
| 250 | 600 | 2300 | Triumph |
| 225 | 514 | 440 | GE-I-14 |
| 200 | 450 | 2200 | GE |
| 200 | 600 | 440 | Westg'h-CS |
| 150 | 1200 | 440 | GE Type I |
| 150 | 600 | 2200 | GE |
| 125 | 3600 | 220/440 | Al.-Ch. AN |
| 125 | 1200 | 440 | Century |
| 125 | 340 | 220 | A-C |
| 100 | 1800 | 2300 | Burke |
| 100 | 1200 | 2200 | Al.-Ch. AR |
| 85 | 3600 | 2200 | GE |
| 75 | 1200 | 220/440 | GE-K505V |
| 75 | 900 | 2300 | GE |
| 60 | 3600 | 2300 | GE-KT |
| 60 | 1800 | 220/440 | A-C, AR |
| 60 | 1800 | 2300 | GE-FTR |
| 50 | 3600 | 440 | R. & M. |
| 50 | 1800 | 220 | Triumph |
| 50 | 900 | 220 | GE |
| 50 | 720 | 2300 | Wtg.-CS |
| 40 | 1800 | 220 | A-C |
| 40 | 1200 | 550 | A-C AN |
| 40 | 900 | 2300 | Wtg.-CS |
| 40 | 900 | 220 | Lincoln |
| 40 | 720 | 440 | GE-KT |
| 35 | 1800 | 220 | GE type I |
| 35 | 600 | 440 | GE-Type I Form M |
| 30 | 1800 | 440 | A-C |
| 30 | 1200 | dual | Master |
| 30 | 900 | 220 | Lincoln |
| 30 | 900 | 220 | Wagner (HI-Torque) |
| 30 | 720 | 220 | GE-BJ |
| 30 | 514 | 440 | Stanley |
| 25 | 3600 | dual | L-A |
| 25 | 1800 | dual | GE |
| 25 | 1200 | 220 | Wesche |
| 25 | 900 | 440 | GE |
| 25 | 680 | 220 | Westgh., type CS |
| 25 | 575 | 220 | GE-type M |

## ENCLOSED SQUIRREL CAGE

| HP | RPM | Volts | Make |
|---|---|---|---|
| 125• | 1200 | 440 | GE-TE-FC-BB |
| 75 | 1200 | 2200 | GE-TE-FC-BB |
| 60 | 900 | 440 | GE-TE-FC-BB |
| 50 | 900 | 440 | Reliance, TE-FC-BB |
| 30 | 3600 | dual | Delco-TE-FC-BB |
| 20 | 1200 | 440 | Wagner |
| 20 | 900 | 440 | GE-TE-FC-BB |
| 15 | 1800 | dual | Delco |
| 15 | 1200 | 220/440 | Delco-TEFC-BB |
| 15 | 900 | 440 | GE-TE-FC-BB |
| 10 | 3600 | 220/440 | F.M. |
| 10 | 1200 | 440 | GE-TE-FC-BB |
| 7½• | 1800 | dual | Wagner-TEFC-BB |
| 7½• | 1800 | dual | Master-TEFC-BB |
| 7½ | 1200 | dual | GE-HI Slip-TE-BB |
| 7½ | 1200 | dual | Delco |
| 7½ | 1090 | 220/440 | GE-HI Slip |
| 7½ | 900 | dual | Delco-TEFC-BB |
| 5 | 3600 | dual | Delco-TE-FC-BB |
| 5• | 1800 | dual | Master-TEI C-BB |
| 5 | 1800 | 220 | Wagner TE-B BB |
| 5• | 1200 | dual | GE-TEFC-BB |
| 3 | 3600 | dual | Delco, TE-FC-BB |
| 3 | 1800 | dual | Delco-TEFC-BB |
| 3 | 900 | dual | Delco |
| 2 | 1800 | dual | Delco-TEFC-BB |

•New Motor

## ENCLOSED SQUIRREL CAGE—Cont'd.

| HP | RPM | Volts | Make |
|---|---|---|---|
| 2 | 1200 | 220 | GE-TE-BB |
| 2 | 900 | 220 | Wagner-TE-BB |
| 1½ | 900 | dual | Delco-TEFC-BB |
| 1½ | 1800 | dual | L. Al-TE-BB |
| 1½ | 1800 | dual | Delco-TEFC-BB |
| 1 | 3800 | 220 | Baskins-TEFC |
| 1 | 1800 | dual | Master-TEFC-BB |
| 1• | 1800 | dual | Delco-TE-BB |
| 1 | 1200 | 220 | GE-KT |
| ¾ | 3600 | 4400 | Delco-TE |
| ¾ | 1800 | dual | Wesche-TE-BB |
| ¾ | 1800 | dual | Delco-TEFC-BB |
| ½ | 1800 | 440 | Delco-TE-BB |
| ½ | 1800 | dual | Delco.-TE-BB |

## SLIP RING MOTORS

| HP | RPM | Volts | Make |
|---|---|---|---|
| 500 | 900 | 440 | GE-3 Brg |
| 400 | 1200 | 2300 | Al. Ch. |
| 375 | 1800 | 2300 | Al. Ch. |
| 350 | 900 | 2300 | Westgh |
| 300 | 720 | 2300 | Al. Ch. |
| 250 | 720 | 440 | GE-Type MT |
| 250 | 300 | 2300 | Al. Ch |
| 235 | 1800 | 220 | GE-I |
| 200 | 1800 | 440 | Al-Ch |
| 150 | 1750 | 440 | GE-MT |
| 125 | 1800 | 2200 | Westgh. Type CW |
| 78 | 1800 | 220 | GE |
| 75 | 900 | 440 | Al.-Ch., ANY |
| 75 | 720 | 2200 | Wagner Type BR |
| 75 | 360 | 220 | GE Type I |
| 60 | 1800 | dual | Al. Ch |
| 60 | 900 | 2300 | Burke |
| 60 | 900 | 220 | Wesche |
| 50 | 1800 | 220 | GE-MT |
| 50 | 900 | 2300 | Ridgeway |
| 50 | 900 | 440 | Wagner |
| 50 | 720 | 440 | Al. Ch. |
| 40 | 1200 | 220 | GE-MT-336 |
| 40 | 900 | 220 | A-C |
| 40 | 720 | 2300 | Wtg.-HF |
| 40 | 720 | 220 | Al. Ch.-ARV |
| 40 | 600 | 2300 | Al. Ch.-ARV |
| 40 | 600 | 220 | Al. Ch.-ARV |
| 40 | 450 | 220 | Triumph-C |
| 35 | 900 | 2200 | GE |
| 35 | 900 | 220 | Al. Ch. |
| 35 | 900 | 2300 | Ridgeway |
| 35 | 720 | 220 | GE |
| 35 | 570 | 550 | GE-I |
| 30 | 1800 | 2300 | Wtg.-CW |
| 30 | 1800 | 2300 | GE |
| 30 | 1200 | 440 | Wagner |
| 30 | 600 | 220 | F. Morse-BV |

## VERTICAL MOTORS

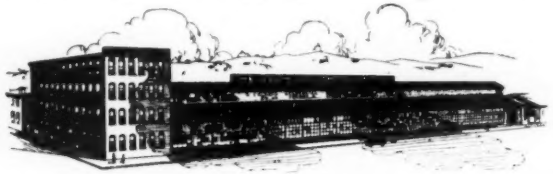
| HP | RPM | Volts | Make |
|---|---|---|---|
| 200 | 1200 | 440 | Al. Ch.-SR |
| 150 | 1200 | 2200 | GE-I-SR |
| 150 | 1200 | 440 | GE-Cage |
| 125 | 1200 | 2300 | Al. Ch.-SR |
| 125 | 1200 | 2300 | Al.Ch.-Cage |
| 100 | 1200 | 440 | GE-Cage |
| 75 | 1200 | 2200 | GE-Cage |
| 75 | 360 | 220 | Ideal-Cage |
| 60 | 1800 | 220 D.C. | GE |
| 60• | 1200 | 440 | Al. Ch.-Cage |

## VERTICAL MOTORS—Cont'd.

| HP | RPM | Volts | Make |
|---|---|---|---|
| 50 | 1200 | 2200 | Wtg.-Cage |
| 50 | 900 | 440 | Al. Ch.-Cage |
| 40 | 1800 | 220 | GE-Cage |
| 40 | 1700 | 230 D.C. | GE |
| 40 | 1200 | 440 | Wtg.-SR |
| 40 | 1200 | 2200 | Westgh.-BB-Cage |
| 35 | 1200 | 2300 | Al. Ch.-Cage |
| 35 | 450 | 440 | GE-Cage |
| 30 | 1200 | dual | Wtg.-Cage |
| 25• | 1550 | 230 D.C | GE |
| 25 | 1200 | 2200 | GE-Cage |
| 25 | 850 | 230 D.C | Wtg. |
| 20• | 1200 | 440 | Al. Ch.-Cage |
| 20 | 800 | 230 D.C | GE-RC |
| 15• | 1800 | 440 | Al. Ch.-Cage |
| 15 | 1750 | 110 D.C | Wtg. |
| 15 | 1150 | 230 D.C | GE |
| 15 | 600 | 440 | Al.-Ch. |
| 12½ | 900 | 220 | L. Al.-Cage |
| 10 | 3400 | 230 D.C | Wtg. |
| 7½ | 1800 | 500 D.C. | Peerless |
| 7½ | 900 | 440 | Burke |
| 7½ | 700 | 230 D.C | GE |
| 6 | 850 | 110 D.C | Rel. |
| 5 | 1400 | 115 D.C. | R. & M. |
| 5 | 600 | 440 | GE-Cage |
| 4 | 1650 | 110 D.C. | Watson |
| 3 | 3600 | dual | Delco |
| 3 | 1700 | 230 D.C. | Watson |
| 3 | 1200 | dual | Wtg.-Cage |

## SYNCHRONOUS MOTORS

| HP | RPM | Volts | Make |
|---|---|---|---|
| 3000 | 720 | 4800 | GE-ATI |
| 1015 | 500 | 2200 | Wtg.-25 cycle |
| 710 | 720 | 13200/6600 | GE |
| 500 | 514 | 440 | GE |
| 435 | 720 | 2300 | GE TYPE ATI |
| 320 | 900 | 2300 | GE-ATI |
| 250 | 1800 | 2300/4160 | GE-ATI |
| 250 | 225 | 2200 | GE-TS |
| 225 | 900 | 4100 | GE-ATI |
| 220 | 600 | 2300 | GE-ATI |
| 200 | 225 | 2300 | Wtg., rotor & stator only |
| 175 | 225 | 220 | GE-TS (rotor & stator only) |
| 160 | 600 | 440 | GE-ATI |
| 160 | 164 | 4/80 | GE-TRF (rotor & stator only) |
| 150 | 1800 | 2200 | GE |
| 150 | 1800 | 220 | GE-ATI, Single Bearing |
| 150 | 720 | 440 | Westgh. |
| 120 | 225 | 220 | E-M, rotor & stator only |
| 115 | 164 | 208 | GE |
| 100 | 1200 | 220 | Wstg Single bearing |
| 95 | 1200 | 220 | Burke |
| 75 | 1200 | 220 | Westgh. |
| 75 | 900 | 2300 | GE-ATI-7552 |
| 60 | 360 | 2200 | GE, rotor & stator |
| 50 | 1200 | 440 | Wagner |
| 50 | 900 | 220/440 | Westgh. |
| 50 | 720 | 440 | GE-TS |
| 50 | 360 | 440 | GE, rotor & stator |
| 50 | 300 | 220/440 | Wstg (rotor & stator only) |
| 40 | 900 | 440 | Wagner |
| 40 | 600 | 550 | GE, rotor & stator |
| 30 | 450 | dual | Wtg., rotor & stator |
| 30 | 360 | 550 | GE |
| 30 | 327 | 220 | E-M, rotor & stator |
| 25 | 1800 | 220 | Wagner |
| 25 | 450 | 220 | E-M, rotor & stator |
| 20 | 1200 | 440 | Wagner |
| 20 | 900 | 220 | Wtg. |
| 20 | 600 | 220 | E-M, rotor & stator |



## D. C. MOTORS

### 115 Volts

| HP | RPM | Description |
|---|---|---|
| 225 | 750 | GE-NYSC |
| 50 | 1200 | Al.-Ch. |
| 35 | 975 | Northern |
| 30 | 1800 | F-M |
| 30 | 200/800 | Sprague |
| 25 | 1150 | Triumph |
| 25 | 750 | GE-MPC |
| 20 | 700 | Triumph |
| 20 | 500/1500 | GE-RF-11 |
| 20 | 400/1200 | GE-RLC fr. 202A |
| 18 | 900 | Sturtevant MP3 |
| 15 | 1200 | J. & L. |
| 15 | 1000 | GE-CE |
| 15 | 975 | F-M |
| 15 | 725 | Westgh.-S fr 6 |
| 12 | 1075 | J. & L. |
| 12 | 580 | Westgh.-SK-113 |
| 10 | 3450 | Imperial |
| 10 | 1700 | Fairbanks-Morse |
| 10 | 680 | J. & L., type C1 |
| 10 | 400/1600 | Watson-BW15B |

## GEAR HEAD MOTORS

### DIRECT CURRENT

| HP | OUTPUT RPM | VOLTS | DESCRIPTION |
|---|---|---|---|
| ¼ | 24 | 230 | Roth |
| ⅓ | 167 | 110 | Jenney-Shunt |
| 1 | 7.64 | 115 | Master-compound |
| 1 | 23 | 115 | Master-compound |
| 1 | 780 | 115 | Crocker-Wheeler-Back Geared |
| 1 | 200 | 110 | Rt. M-Back Geared |
| 1 | 428 | 115 | Master-compound |
| 1 | 850 | 115 | Triumph-compound |
| 1 | 8 | 115 | Master-compound |
| 1½ | 27.5 | 115 | Master-compound |
| 2 | 6.35 | 115 | Master-compound |
| 3 | 85 | 230 | C-W |
| 3 | 123 | 115 | Master-compound |
| 3 | 144 | 115 | Master-compound |
| 3 | 427 | 230 | Westgh.-shunt |
| 5 | 500 | 230 | C-W, type CM |
| 5 | 627 | 110 | Master-compound |
| 7½ | 84 | 115 | Westgh. with speed reducer |
| 7½ | 256 | 230 | C-W-shunt |
| 10 | 2030 | 230 | Westgh. TEBR |

## D. C. GENERATORS

### 125 Volts

| KW | RPM | Description |
|---|---|---|
| 540 | 1000/1300 | Westgh.,single bearing |
| 500 | 750 | GE-MCF |
| 300 | 1500 | GE-CC |
| 200 | 900 | GE-MPC |
| 200 | 800 | GE-DMCI |
| 100 | 1000 | WE-DLC |
| 100 | 900 | Wstg.-SK single bearing |
| 55 | 1000 | GE-Type TD |
| 40 | 600 | J. & L.-F Ped. Type |
| ¾ | 1165 | GE-DLC |
| 11.25 | 1400 | Westgh.-SK-single bearing |

## D. C. GENERATORS

### 230 Volts

| KW | RPM | Description |
|---|---|---|
| 400 | 1200 | Wstgh. single bearing |
| 200 | 1200 | GE-MPC single bearing |
| 175 | 450 | Westgh. |
| 60 | 1200 | Westgh.-SK |
| 50 | 1200 | Al. Ch.-E-127 |
| 35 | 1800 | GE-RC |
| 30 | 900 | Triumph |
| 22½ | 765 | Westgh.-SK |
| 20 | 1750 | Delco Ballbearing |
| 18 | 300 | Burke |
| 15 | 350 | Westgh.-SK |

**AC & DC MOTORS • GENERATORS • PUMPS**
**SYNCHRONOUS MOTORS • CONTROL EQUIPMENT**
**MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT**
**STEAM ENGINE GEN. SETS • SLIP RING MOTORS**

**927 HARRIET ST.**
**PHONE MA. 3024**
**CINCINNATI 3, OHIO**

Our 43rd Year

# WAGNER

Quality and Service

## "CERTIFIED REBUILT"

## DEPENDABLE ELECTRICAL EQUIPMENT AT LOW COST

## MOTORS . . . GENERATORS . . . M-G SETS

**PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS**

***PARTIAL STOCK LISTING—WRITE, WIRE OR PHONE YOUR REQUIREMENTS***

250 KW Allis-Chalmers M-G Set, D.C. 120/240V. output, 363 H.P. Synch. Motor, 3/60/440V. 1200 RPM, A.C. & D.C. panels, late model, imm hipment.

### M-G SETS

| KW | Mfr. | Input V | Output V |
|---|---|---|---|
| 450 | Gen. Elec.* | 2300 AC | 275 DC |
| 300 | Allis Ch.* | 220/440 AC | 250 DC |
| 250 | Allis Ch.* | 440 AC | 120/240 DC |
| 200 | Ridgeway* | 2300/4000 AC | 550 DC |
| 200 | Gen. Elec. | 220/440 AC | 125/250 DC |
| 150 | Cr. Wheeler* | 220/440 AC | 250 DC |
| 105 | Century b.b. | 220/440 AC | 70 DC |
| 100 | Allis Ch.* | 220/440 AC | 125/250 DC |
| 100 | Allis Ch. | 2200 AC | 250 DC |
| 100 | Gen. Elec.* | 220/440 AC | 125 DC |
| 75 | Cr. Wheeler b.b. | 220/440 AC | 250 DC |
| 75 | Gen. Elec. (2) | 220/440 AC | 125 DC |
| 50 | Gen. Elec. | 220/440 AC | 250 DC |
| 50 | Gen. Elec. | 220/440 AC | 125 DC |
| 40 | Gen. Elec. | 220/440 AC | 120 cycle |
| 40 | North'n Conv. | 220 AC | 230 DC |
| 35 | Gen. Elec. | 220/440 AC | 48 DC |
| 30 | Gen. Elec. | 220/440 AC | 250 DC |
| 30 | Elec. Prod.* | 220/440 AC | 50 DC |
| 20 | Star b.b. (2) | 220/440 AC | 250 DC |
| 15 | Gen. Elec. | 220/440 AC | 125 DC |
| 10 | Allis Ch. (2) | 220/440 AC | 250 DC |

*Synch. motor drive.

### D. C. MOTORS

| H.P. | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 180 | Cr. Wheeler b.b. | TEFC | 230 | 800 |
| 100 | Whse. | SK181 | 230 | 450/900 |
| 100 | Gen. Elec. | C | 230 | 575/1000 |
| 100 | Gen. Elec. | RC36 | 115 | 1150 |
| 75 | Cr. W. New b.b. | CMC | 230 | 1150 |
| 75 | Allis Ch. | E-149 | 230 | 500 |
| 75 | Whse. | S13L | 115 | 570 |
| 75 | North'n | K20 | 230 | 1750 |
| 60 | Gen. Elec. | RC36 | 230 | 650 |
| 60 | Elec. Dyn. | 25-S | 230 | 450/900 |
| 50 | Allis Ch. | E131 | 230 | 850 |
| 50 | Gen. Elec. | RC33 | 230 | 1100 |
| 40/60 | Whse. (2) | SK170 | 230 | 500/1000 |
| 40 | Sprague dyna. | LC | 230 | 750/2000 |
| 40 | Gen. Elec. | RC32 | 230 | 1150 |
| 40 | Gen. Elec. | CD113 | 230 | 850 |
| 35/80 | Gen. Elec. | CD123 | 230 | 575/1150 |
| 35 | Ideal | DV350 | 230 | 400/1200 |
| 30 | Whse. (2) | SK93 | 230 | 1750 |
| 30 | Whse. | S-7 | 115 | 900 |
| 30 | Gen. Elec. | RC31B | 230 | 1150 |
| 25 | Sprague dyna. | LC | 230 | 750/2000 |
| 25 | Chand son (4) | C13 | 115 | 850 |
| 25 | Gen. Elec. | CD85 | 230 | 1750 |
| 20 | Gen. Elec. | RF12 | 230 | 400/1600 |
| 20 | Whse. | SK93 | 230 | 1150 |
| 20 | Reliance | T | 230 | 850 |
| 20 | Gen. Elec. | CD85 | 230 | 1180 |
| 20 | Whse. | SK130 | 230 | 500/1500 |
| 15 | Whse. (3) | SK90 | 230 | 825 |
| 15 | El. Dyn. b.b. | 328 | 230 | 1750 |
| 15 | El. Dyn. b.b. | 18S | 230 | 300/1200 |
| 15 | Whse. (2) | SK80L | 230 | 1150 |
| 15 | G.E. TEFC b.b. | CD83 | 230 | 1750 |

### D. C. GENERATORS

| KW | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 150 | Cr. Wheeler b.b. | TEFC | 250 | 1200 |
| 105 | Century b.b. | 1500 amp. | 70 | 1200 |
| 100 | Gen. Elec. | RC17 | 125 | 1200 |
| 100 | Gen. Elec. | C | 250 | 750 |
| 75 | Allis Ch. | E | 250 | 750 |
| 75 | Whse. | S | 125 | 600 |
| 75 | Cr. Wheeler b.b. | CCD | 250 | 1450 |
| 75 | Gen. Elec. (2) | RC36 | 125 | 1200 |
| 50 | Allis Ch. | E-147 | 250 | 850 |
| 50 | Gen. Elec. | RC | 250 | 1250 |
| 40 | Gen. Elec. | RC32 | 250 | 1450 |
| 30 | Elec. Prod. | BP | 50 | 1150 |
| 30 | Gen. Elec. | RC | 250 | 1500 |
| 20 | Whse. | SK93 | 250 | 1750 |
| 15 | Star b.b. | SQ | 250 | 1750 |

### EXPLOSION PROOF MOTORS

from 1 to 20 H.P. . . . . std. speeds

### A. C. MOTORS—25 CYCLE

| H.P. | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 180 | Whse. | HF | 440 | 500 |
| 150 | Gen. Elec. | IK-16 | 440 | 750 |
| 50 | Allis Ch. | ANY | 440 | 750 |
| 50 | G.E. int. | MTC5337 | 440 | 750 |
| 50 | G.E. | I-K | 440 | 750 |
| 50 | Gen. Elec. | KT339 | 440 | 1500 |
| 40 | Gen. Elec. | KT343 | 440 | 750 |
| 20 | Gen. Elec. | KT527 | 440 | 750 |
| 15 | Whse. TEFC | CS365 | 220/440 | 1500 |

### A. C. GENERATORS—60 CYCLE

| KVA | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 625 | Gen. Elec. | ATB | 2300 | 450 |
| 500 | Allis Ch. | 3 brg. | 240/480 | 360 |
| 300 | Gen. Elec | ATB | 240/480 | 720 |
| 250 | Whse. | G | 2300 | 600 |
| 200 | Gen. Elec. | ATB | 240/480 | 600 |
| 187 | Gen. Elec. | ATB | 240/480 | 900 |
| 150 | Gen. Elec. | ATB | 2300 | 450 |
| 150 | Gen. Elec. | ATB | 240/480 | 900 |
| 125 | Gen. Elec. | ATB | 240/480 | 300 |
| 100 | Gen. Elec. | ATB | 240/480 | 900 |
| 100 | Gen. Elec. | ATB | 240/480 | 1200 |
| 75 | Gen. Elec. New b.b. | ATI7552 | 240/480 | 1200 |
| 56 | Gen. Elec.(2) | ATB | 240/480 | 1200 |
| 55 | Gen. Elec. | ATB | 240/480 | 900 |
| 31 | Gen. Elec. | ATI7536 | 240/480 | 1200 |
| 25 | Whse. b.b. | 1 ph. | 120/240 | 900 |

### A. C. MOTORS—SLIP RING

**3 Phase 60 Cycle 220 or 440 Volts**

| Qu. | H.P. | Mfr. | Type | Speed |
|---|---|---|---|---|
| 1— | 600 | Gen. Elec. | I-M | 360 |
| 1— | 500 | Allis Ch. | ANY | 450 |
| 1— | 350 | G. E. 2200 V. | I-M | 360 |
| 2— | 300 | Allis Ch. 2200 V. | ANY | 720 |
| 1— | 300 | G.E. 2200 V. | I-M | 1800 |
| 1— | 300 | Whse. 2200 V | CW | 600 |
| 1— | 250 | Allis Ch. 2200V. | ANY | 514 |
| 1— | 200 | Gen. Elec. | I-M | 360 |
| 1— | 200 | Gen. Elec. | I-M-17 | 600 |
| 1— | 200 | Gen. Elec. | IM-17A | 450 |
| 1— | 150 | Whse. | MW | 450 |
| 1— | 150 | G.E. 2200/4000 V. | I-M | 1200 |
| 1— | 150 | Allis Ch. | ANY | 600 |
| 1— | 100 | Allis Ch. | ANY | 1800 |
| 1— | 100 | Al. Ch. b.b. NEW | ARY | 600 |
| 1— | 100 | Allis Ch. | ANY | 720 |
| 1— | 100 | Whse. int. 2200 V. | CI856C | 600 |
| 1— | 100 | Whse. int. | CI-756A | 720 |
| 1— | 100 | Fair. Morse b.b. | HV | 900 |
| 1— | 75 | Gen. Elec. | I-M-E13 | 1200 |
| 2— | 75 | Gen. Elec. | IM-14 | 720 |
| 1— | 75 | G.E. int. duty | MTC5342 | 900 |
| 1— | 75 | Ideal int. | AVE | 1200 |
| 1— | 75 | Gen. Elec. | MT558 | 900 |
| 2— | 75 | Gen. Elec. | IN-14 | 600 |
| 1— | 75 | Gen. Elec. | MT337 | 1800 |
| 1— | 50 | Allis Ch. | ANY | 900 |
| 1— | 50 | Howell | SR437 | 1200 |
| 1— | 50 | Fair. Morse | BV | 720 |
| 1— | 50 | Gen. Elec. int. | ITC | 600 |
| 1— | 50 | Whse. int. | CI | 600 |
| 1— | 50 | Gen. Elec. | I-M | 720 |
| 1— | 40 | Gen. Elec. | MT336 | 900 |
| 1— | 37 | G.E. int. | ITC | 600 |
| 2— | 30 | Gen. Elec. | MT536 | 1200 |
| 1— | 30 | Gen. Elec. | OMT336 | 1200 |
| 1— | 30 | Gen Elec. | MT346 | 600 |
| 2— | 25 | Gen. Elec. | MT332 | 900 |
| 1— | 25 | Triumph | SR | 1200 |
| 1— | 25 | Gen. Elec. | I-M | 600 |
| 1— | 20 | Gen. Elec. | MT503 | 1800 |
| 12— | 10 | Reliance New b.b. | AW-324 | 1800 |

### A. C. MOTORS—SYNCHRONOUS

| H.P. | Mfr. | Type | Volts | Speed |
|---|---|---|---|---|
| 300 | Gen. Elec. | ATI | 220/440 | 720 |
| 300 | Whse. | G | 220/440 | 600 |
| 250 | Ideal | 2BC-M4 | 2200 | 450 |
| 220 | G.E. 3 brg. S PF | ATI | 220/440 | 600 |
| 200 | G.E. S PF | ATI | 220/440 | 900 |
| 150 | Gen. Elec. S PF | ATI | 2200 | 450 |
| 150 | Gen. Elec. | ATI | 220/440 | 300 |
| 125 | G.E. splprf. S PF | TS955 | 220/440 | 1200 |
| 125 | Gen. Elec. | ATI | 220/440 | 900 |

### A. C. MOTORS—SQUIRREL CAGE

**3 Phase 60 Cycle 220 or 440 Volts**

| Qu. | H.P. | Mfr. | Type | Speed |
|---|---|---|---|---|
| 1— | 400 | Whse. 2200V. | CS | 1800 |
| 1— | 300 | Gen. Elec. | KT563 | 1200 |
| 1— | 200 | Reliance b.b. NEW | C8085 | 1800 |
| 1— | 200 | Allis Ch. | AN | 1200 |
| 1— | 150 | Gen. Elec. | I-K-16 | 600 |
| 1— | 150 | Whse. 2200 V. | CS771-1C | 1800 |
| 1— | 150 | Reliance b.b. NEW | B8085 | 1200 |
| 1— | 150 | Gen. Elec. | IK-16 | 900 |
| 1— | 125 | Reliance b.b. NEW | C8085 | 1200 |
| 2— | 125 | Allis Ch. 2200 V. | AN | 1200 |
| 1— | 125 | Gen. Elec. | IK-16 | 450 |
| 1— | 125 | Cont. 2200 V. b.b. | SC | 1800 |
| 1— | 125 | Gen. Elec. | KT339 | 3600 |
| 2— | 125 | Rel. TEFC NEW | B8085 | 1800 |
| 1— | 100 | Gen. Elec. | I-K | 1800 |
| 5— | 100 | Allis Ch. 2200 V. | AR226 | 1200 |
| 1— | 100 | Reliance b.b. NEW | C8085 | 900 |
| 1— | 100 | Elec. Machy. | b.b. | 1200 |
| 1— | 100 | Rel. TEFC NEW | C8085 | 1200 |
| 1— | 100 | G.E. b.b. NEW | KB048 | 1800 |
| 1— | 100 | Cont. TEFC | NP882 | 1200 |
| 1— | 100 | Gen. Elec. | IK-15 | 720 |
| 2— | 75 | Gen. Elec. | IK | 600 |
| 1— | 75 | Gen. Elec. | I-K 14 | 720 |
| 1— | 75 | Reliance b.b. NEW | C8084 | 900 |
| 1— | 75 | Gen. Elec. | KT532 | 900 |
| 1— | 75 | Reliance TEFC NEW | C8084 | 1200 |
| 1— | 75 | Reliance b.b. NEW | C805 | 1800 |
| 1— | 75 | Gen. Elec. | KT329Y | 3600 |
| 2— | 75 | Reliance b.b. NEW | C808 | 1200 |
| 1— | 75 | Gen. Elec. | KT347 | 1200 |
| 1— | 60 | Gen. Elec. | KT852 | 720 |
| 1— | 60 | Gen. Elec. | KT348 | 900 |
| 2— | 60 | Reliance b.b. NEW | B804 | 1800 |
| 2— | 60 | Rel. TEFC NEW | C805 | 1200 |
| 2— | 60 | Reliance b.b. NEW | C804 | 1200 |
| 2— | 60 | Whse. H.T. | CS804 | 1800 |
| 1— | 60 | Wagner b.b. | R7444 | 3600 |
| 2— | 50 | Whse. b.b. NEW | CS6053 | 1800 |
| 1— | 50 | G.E. NEW b.b. HT | KG405 | 1800 |
| 2— | 50 | Reliance b.b. NEW | C445 | 1200 |
| 2— | 50 | Gen. Elec. | KT336 | 1200 |
| 1— | 50 | Gen. Elec. | KT343 | 900 |
| 1— | 50 | Whse. hsiip | WL807 | 900 |
| 2— | 50 | Whse. b.b. | CS804 | 1200 |
| 2— | 40 | Gen. Elec. | KT332 | 600 |
| 1— | 40 | Gen. Elec. b.b. | KF404S | 3600 |
| 2— | 40 | Gen. Elec. | KT327 | 1800 |
| 4— | 40 | Al. Ch. 3 speed | ARX | 900/600/450 |
| 1— | 40 | Gen. Elec. | KT330 | 900 |
| 2— | 40 | Reliance b.b. NEW | C404 | 1800 |
| 2— | 40 | Rel. TEFC NEW | C445 | 1200 |
| 3— | 40 | G.E. | KT532 | 1200 |
| 2— | 35 | Gen. Elec. | I-K | 720 |
| 2— | 30 | Gen. Elec. | KT532 | 900 |
| 1— | 30 | Al.Ch. TEFC b.b. | ARZ445 | 900 |
| 2— | 30 | Howell b.b. 4 speed | SC | 1800 |
| 2— | 30 | G.E. NEW b.b. | KB45 | 1800 |
| 2— | 30 | G.E. NEW hiteq | KG365 | 1800 |
| 2— | 30 | G.E. TEFC b.b. | K404 | 1800 |
| 1— | 30 | Gen. Elec. | KT338 | 720 |
| 1— | 30 | Wagner | 22T8P | 900 |
| 1— | 30 | Whse. | CS846 | 900 |
| 2— | 30 | Reliance b.b. NEW | C405 | 1200 |
| 2— | 30 | Reliance TEFC NEW | C444 | 1200 |
| 1— | 30 | Cr. Wheeler b.b. | SC30Y | 1800 |
| 2— | 25 | Rel. TEFC NEW | C444 | 900 |
| 3— | 25 | Reliance b.b. NEW | C364 | 1800 |
| 2— | 25 | Reliance TEFC NEW | B365 | 1800 |
| 2— | 25 | Reliance b.b. NEW | C404 | 1200 |
| 2— | 25 | Reliance TEFC NEW | C405 | 1200 |
| 2— | 25 | Whse. NEW spl. b.b. | CS365 | 1800 |
| 3— | 25 | Whse. | CS846 | 900 |
| 2— | 25 | Gen. Elec. | I-K | 900 |
| 1— | 20 | Reliance b.b. NEW | C404 | 900 |
| 1— | 20 | G.E. TEFC b.b. | K404 | 1200 |
| 4— | 20 | Reliance b.b. NEW | C364 | 1800 |
| 2— | 20 | L.A. NEW exp. prf. | EX364 | 1800 |
| 2— | 20 | Whse. NEW b.b. spl. | CS364 | 1800 |
| 2— | 20 | Gen. Elec. | KT312 | 1200 |
| 1— | 20 | Whse. | C8 | 1200 |
| 2— | 20 | G.E. NEW b.b. | K365 | 1200 |
| 1— | 20 | Whse. b.b. | CS326 | 3600 |


## ARTHUR WAGNER COMPANY

1435 W. RANDOLPH STREET CHICAGO 7, ILL. MONroe 6-7409

# *You can look with confidence to* RE-NU-BILT EQUIPMENT

**REBUILT IN ACCORDANCE WITH N.I.S.A. STANDARDS**

RE NU BILT — BELYEA — MOTORS

**SUCCESSFUL OPERATION GUARANTEED**

## MOTOR GENERATOR SETS
**3 ph. 60 cycle**

| Qu. | KW | Make | Speed | D.C. Volts | A.C. Volts |
|---|---|---|---|---|---|
| 1 | 1800 | G.E. | 600 | 125/250 | 4000 |
| 1 | 1500 | G.E. | 600 | 600 | 2300/4150 |
| 1 | 1500 | G.E. | 360 | 275 | 2200/4400 |
| 1 | 1250 | G.E. | 600 | 575 | 2300 |
| 1 | 1000 | Whse | 900 | 600 | 2300/4150 |
| 1 | 1000 | Whse | 720 | 600 | 2300/4150 |
| 1 | 1000 | West. | 514 | 250 | 4150 |
| 1 | 1000 | Whse. | 514 | 600 | 4150 |
| 1 | 800 | G.E.(3U) | 1200 | 120/240 | 2300 |
| 1 | 750 | Whse | 900 | 250 | 2300 |
| 1 | 600 | G.E. | 720 | 600 | 2300/4150 |
| 1 | 500 | G.E. | 720 | 125 | 2300/4000 |
| 2 | 400 | G.E. | 720 | 250 | 440/2300 |
| 1 | 400 | G.E. | 1200 | 120/240 | 440 |
| 1 | 350 | G.E. | 900 | 125 | 2300/4150 |
| 1 | 300 | G.E. | 1200 | 250 | 440 |
| 1 | 150 | G.E. | 1200 | 250 | 550 |
| 1 | 150 | Cr. Wh. | 1200 | 250 | 440 |
| 1 | 140(3U) | Cr. Wh. | 690 | 125/250 | 2300 |
| 1 | 100 | G.E. | 1170 | 125 | 220 |
| 1 | 75 | Cr. Wh | 1170 | 250 | 220/440 |
| 1 | 75 | Cr. Wh | 1200 | 250 | 550 |

## SYNCHRONOUS CONDENSERS

| Qu. | Kva. | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 1 | 5140 | Whse. | | 4150 | 600 |
| 1 | 4000 | G.E. | TSC | 2400/4800 | 900 |
| 1 | 3000 | Whse. | | 4800 | 720 |

## ROTARY CONVERTERS
**60 Cycle**

| | Make | Speed | D.C. Volts | A.C. Volts |
|---|---|---|---|---|
| 1—2000 | G.E. | 514 | 600 | 13800 |
| 1—2000 | G.E. | 450 | 600 | 2300 |
| 1—1000 | Whse. | 900 | 600 | 11000 |
| 1— 750 | Whse. | 900 | 600 | 13200 |
| 3— 500 | Whse. | 1200 | 250 | 11000 |

## FREQUENCY CHANGER SETS

**1—1000 KW—Al. Ch. Consisting of 1400 HP, 2300 V. 3 ph. 25 cy. Motor and 1000 K, 2300 V. 3 ph. 62½ cy. gen. switch exciter.**

**1—1000 KW—GE—2 unit—3 Brg. Consisting of—1400 HP—4400 V., 3 ph. 25 cy. Motor and 1000 KW—2300 V. 2 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)**

**1—320 KW-GE—2 Unit—3 Brg. consisting of 600 HP—440 V., 3 ph. 60 cy., 8 pf. Syn. Motor and 400 KVA, 8 pf., type AT—3 ph., 120 cy, 720 volt AC generator with direct connected exciter.**

## SPECIAL—MERCURY ARC RECTIFIERS

**1—750 KW—GE—Type RMW—6 Anode 575 V., D.C. Form C with 2300 V., 60 cycle transformer and switching equipment.**

**1—1000 KW—American B.B. Type GRZ-612—12 anode 625 V.D.C. with 1040 KVA O15C—3 phase—13200/6600V-25/60 cycle transformer with full automatic switching equipment along with 2 distribution panels.**

**1—1000 KW—Al.Ch. type B-612—12 anode 625 V.D.C. with 1140 KVA O15C—3 phase—13500V.—60 cycle transformer with manually operated switching equipment along with voltage regulator and grid control.**

## D. C. MOTORS

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 1—1750 | Whse | | 600 | 525/720 |
| 2—1500 | Whse. | | 525 | 600 |
| 1—1300 | Whse. | | 600 | 425 |
| 1—800/1000 | Whse. | | 450 | 600/720 |
| 1—700 | G.E. | MCF | 600 | 150/525 |
| 1—650 | G.E. | MPC | 250 | 115/145 |
| 1—600 | Al. Ch | MILL | 230 | 400/800 |
| 1—300/400 | G.E. | DYNA | 250 | 1325/2500 |
| 1—335 | Whse. | MQ | 250 | 300/900 |
| 1—200/300 | G.E. | MPC | 230 | 360/920 |
| 1—275 | Whse. | QM-600-6 | 230 | 425/850 |
| 1—250 | G.E. | MPC | 230 | 400/500 |
| 1—230 | Al. Ch. | | 230 | 700 |
| 1—150 | G.E. | MPC | 230 | 250/450 |
| 1—150 | Cr. Wh. | CCM | 230 | 300/1050 |
| 1—150 | G.E. | | 600 | 250/750 |
| 10—150 | Cr. Wh. | 83H | 230 | 890 |
| 1—150 | Cr. Wh. | CMC-65H | 230 | 1150 |
| 2—125 | G.E. | CO-1832 | 230 | 625 |
| 1—125 | El. Dy. | 308 | 230 | 750/1500 |
| 1—115 | Cr. Wh. | JHL | 230 | 1200 |
| 3—101 | Whse. | 8K | 230 | 485/950 |
| 1—90 | G.E. | CDM-1242Z | 115 | 1800 |
| 1—50/100 | G.E. | CD-175 | 230 | 365/730 |
| 2—80 | El. Dy. | 308 | 230 | 475/1350 |
| 1—75 | Cr. Wh. | CMC | 230 | 500/1500 |
| 1—75 | Whse. | 8K-100L | 125 | 650 |
| 2—75 | El. Dy. | 25-8L | 230 | 750/1750 |
| 3—60/75 | Whse. | 8K-200 | 115 | 300/700 |
| 4—75 | Cr. Wh. | 53-H | 230 | 980 |
| 2—75 | G.E. | CDM-1126Y | 230 | 2000 |
| 1—60 | Whse. | 8K-160 | 460 | 680 |
| 1—60 | El. Dy | 25-8 | 230 | 625/1050 |
| 1—60 | Whse. | 8K | 230 | 500/1000 |
| 1—60 | Whse. | 8K-131 | 230 | 500/1500 |
| 1—60 | El. Dy. | 258 | 230 | 750/1500 |
| 2—50 | G.E. | RCP-31B | 230 | 1700 |
| 4—50 | Whse. | Hoist | 230 | 400 |
| 1—50 | Whse. | 8K-153 | 230 | 690/1035 |
| 1—50 | Cr. Wh. | CMC-80H | 230 | 380/750 |
| 1—40 | Whse. | 8K-103 | 230 | 1800/2400 |
| 2—35 | G.E. | RF-14 | 230 | 250/1000 |
| 2—30 | G.E. | CD-115 | 230 | 500/1500 |
| 7—25/30 | G.E. | CD-105 | 230 | 690/2070 |
| 3—25 | Whse | 8K-93 | 230 | 1310/1750 |
| 2—20 | Whse. | 8K-90 | 230 | 1150 |
| 1—20 | Whse. | 8K-93 | 230 | 1750 |
| 2—20 | GE | CD-103 | 230 | 400/1600 |

## TURBO GENERATORS

| Qu. | KW | Make | Desc. |
|---|---|---|---|
| 1 | 4000 | G.E. | Auto Extraction 250# ISP 15# Ext. 2600V. 3 ph. 60 cy. |
| 1 | 2000 | G.E. | Condensing, 175# ISP—6600V. 3 ph. 60 cy. |
| 1 | 1000 | G.E. | Condensing 135/150# ISP 2300/4150 V. 3 ph. 60 cy. |
| 2 | 750 | G.E. | Condensing 250/275# ISP 440V. 3 ph. 60 cy. (New 1944) |
| 1 | 450 | Whse. | Condensing 350/275# ISP 440V. 3 ph. 60 cy. |
| 1 | 300 | G.E. | Non-condensing 150/175# ISP 5/15# B.P. 480V 3 ph 60 cy. |
| 1 | 300 | Al. Ch. | Condensing 425# ISP Geared to 1200 RPM. 120/240V D. C. |
| | 200 | Cr. Wh. | Condensing 250# ISP Geared to 1200 RPM—125V D.C. Gen. |
| 1 | 200 | Whse. | Non-condensing 150# ISP 7# B.P. 240V. 3 ph. 60 cy. |
| | 100 | G.E. | Non-condensing 150# ISP 2300V. 3 ph. 60 cy. |

## A. C. MOTORS
**3 ph. 60 cycle**
**SYNCHRONOUS**

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 2—3500 | G.E. | TS | 2300 | 257 |
| 1—2100 | C.E. | ATI | 4600 | 514 |
| 2—2000 | Whse. | | 2300 | 120 |
| 1—1000 | Whse. | | 2300 | 189.5 |
| 2— 900 | Al. Ch | (New) | 2200 | 150 |
| 1— 650 | Whse. | NG | 2200 | 138 |
| 1— 600 | Whse. | Syn | 440 | 360 |
| 1— 500 | G.E. | ATI | 480 | 900 |
| 1— 500 | G.E. | TS | 4150 | 600 |
| 1— 450 | Whse. | Eng | 2200 | 128.5 |
| 2— 350 | G.E. | TS | 2200 | 150 |
| 1— 320 | G.E. | ATI | 2300 | 600 |
| 1— 300 | G.E. | ATI | 440 | 720 |
| 1— 300 | Whse. | | 2300 | 720 |
| 1— 300 | Al. Ch. | | 440 | 600 |
| 1— 145 | G.E. | ATI | 550 | 720 |
| 2— 125 | G.E. | ATI | 440 | 450 |
| 1— 100 | Whse. | | 550 | 600 |
| 2— 100 | G.E. | TS-7651 | 440 | 450 |
| 1— 100 | G.E. | TS | 440 | 1800 |
| 1— 100 | E.M. | Unused | 440 | 600 |

## SLIP RING

| | | | | |
|---|---|---|---|---|
| 1—1000 | Whse. | CW | 2300 | 700 |
| 2— 700 | Whse. | CW | 2300 | 900 |
| 1— 500 | G.E. | IP | 550 | 505 |
| 1— 500 | G.E. | IM-Mill | 2200 | 450 |
| 3— 450 | G.E. | IM | 440 | 900 |
| 1— 600 | G.E. | MT 412 | 440/2300 | 705 |
| 1— 300 | Whse. | CW | 2200 | 900 |
| 1— 350 | G.E. | MT-442Y | 2200/4000 | 253 |
| 1— 300 | Al. Ch. | 3 Brg. | 2300 | 505 |
| 1— 300 | G.E. | IM | 440 | 720 |
| 9— 300 | Al. Ch | ANY | 2200 | 708 |
| 1— 250 | G.E. | MT-424Y | 4000 | 257 |
| 1— 250 | G.E. | MT-559S | 2200 | 1750 |
| 4— 100 | G.E. | MT-566Y | 440/2200 | 425 |
| 2— 100 | G.E. | IM-16 | 2200 | 435 |
| 2— 100 | G.E. | IM | 440 | 600 |
| 2— 100 | Al. Ch. | AK | 2200 | 1200 |
| 1— 75 | Whse. | CW-761 | 2300 | 1750 |
| 1— 60 | Cr. Wh. | 123-AQ | 220 | 700 |
| 2— 50 | Whse. | CI-638A | 220 | 870 |
| 2— 50 | Whse. | CIW-50 | 440 | 870 |

## SQUIRREL CAGE

| | | | | |
|---|---|---|---|---|
| 1— 250 | G.E. | KT-559 | 440 | 800 |
| 1— 200 | G.E. | IK | 550 | 865 |
| 1— 200 | G.E. | KT-557 | 440 | 1800 |
| 1— 125 | Whse. | M8 | 440 | 485 |
| 1— 125 | (New) G.E. | KF-TEFC | 440 | 1190 |
| 1— 125 | G.E. | KF-TEFC | 440 | 3585 |
| 2— 100 | Al. Ch. | AR | 2200 | 1170 |
| 1— 100 | G.E. | IK-Vert. | 2300 | 450 |
| 2— 100 | G.E. | KT-543 | 220/440 | 1750 |
| 1—200/112 | GE | KF-559BS | 440 | 1170/885 |

## TRANSFORMERS
**60 Cycles**

| Qu. | KVA. | Make | Type | Ph. | Voltages |
|---|---|---|---|---|---|
| 1 | 2500 | Packard | AT | 3 | 13500x2300 |
| 1 | 2500 | Al. Ch. | OISC | 3 | 13200x2300 |
| 3 | 1000 | Pitts | OISC | 1 | 13200x2300 |
| 3 | 1250 | G.E. | H | 1 | 6600 x 550 |
| 1 | 1050 | G.E. | WCTH | 3 | 11000 x 445 |
| 1 | 1000 | Maloney | OISC | 3 | 13200 x 480 |
| 1 | 600 | Penn | OISC | 3 | 13200 x 120/208 |
| 1 | 600 | Al. Ch. | OISC | 3 | 4000/2300 x 216 |
| 3 | 333 | Pitts | OISC | 1 | 26400 x 2600 |
| 3 | 250 | Al. Ch. | OISC | 1 | 2200 x 130 |
| 3 | 200 | Whse. | OISC | 1 | 7200 x 240/480 |
| 6 | 167 | G.E. | OISC | 1 | 2400 x 240/480 |

## SPECIAL OFFERING

**1 Set—36 New Factory Armature Coils. For 3250 KW G.E. Generator Rigid Frame. Type ATB2—3600 RPM, 3 phase, 60 cycle, 480 volts.**

*Remember this name* **BELYEA COMPANY, INC.**

**OUR 41 YEAR REPUTATION IS YOUR PROTECTION**

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# L. J. LAND Guaranteed Electrical Equipment

40th Year

## 1 YEAR GUARANTEE

## RELIABLY REBUILT—DEPENDABLE EQUIPMENT

### PARTIAL LISTINGS ONLY

### MOTORS — 115 V. D.C.

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 300 | West. | SK | 900 |
| 100 | Cr.Wh. | CMC | 900 |
| 40 | G.E. | CD-113 | 850 |
| 30 | West. | S | 600 |
| 25 | G.E. (2) | CD | 1800 |
| 25 | West. | SK-103 | 1150 |
| 25 | Cr.Wh. | CCM | 750 |
| 25 | West. | SA | 600/1200 |
| 15 | E.D. | 7½S | 650/1230 |
| 15 | Cr.Wh. | CM | 650 |
| 12½ | G.E.(3) | CDM-85 | 930/1160 |
| 12½ | G.E. | *CDM-95 | 930/1160 |
| 10 | Century | DN-334 | 1750 |
| 10 | G.E.(2) | RC | 1200 |
| 10 | Al.Ch. | | 900 |
| 10 | E.D. | 7½S | 425/1700 |

### GENERATORS — A.C.

| KW | Make | Type | Speed |
|---|---|---|---|
| 216 | West. | G | 900 |
| 180 | G.E. | ATB | 900 |
| 100 | G.E. | ATB | 360 |
| 75 | G.E.(2) | ATB | 1200 |
| 50 | F-M | GG | 1200 |
| 15 | G.E. | ASI | 1200 |

### GENERATORS — A.C. Driven by D.C. Motors

| KVA | Make | D.C. Input | A.C. Output |
|---|---|---|---|
| 288 | West. | 115 | 450 |
| 75 | G.E. | 230 | 240 |
| 50 | Star | 115 | 120 |
| 35 | G.E. | 230 | 220 |
| 31 | Idea | 115 | 440 |
| 31 | El. Machry. | 230 | 440 |
| 18 | G.E. | 230 | 120/240 |
| 10 | Burke | 115 | 120 |
| 7½ | Hertner | 115 | 440 |
| 5 | El. Spec. | 115 | 110 |
| 1¼ | Al. Ch. | 230 | 110 |

### Frequency Changers and Generators

| Size | Make | Output Frequency |
|---|---|---|
| 150 KW | G.E. | 150 cy. |
| 154 KVA | G.E. | 150 cy. |
| 125 KVA | West.(2) | 180 cy. |
| 50 KW | G.E. | 120 cy. |
| 40 KW | G.E. | 100 cy. |
| 30 KW | G.E. | 90 cy. |
| 15 KW | G.E. | 408 cy. |
| 10 KW | G.E. | 200/700 cy. |
| 7½ KW | G.E. | 408 cy. |
| 3 KW | G.E. | 408 cy. |

### GENERATORS 600 V. D.C.

| KW | Make | Speed |
|---|---|---|
| 400 | G.E.(4) | 1200 |
| 200 | Cr.Wh. | 900 |
| 60 | G.E. | 1200 |
| 30 | Burke | 1750 |

### GENERATORS 250 V. D.C. Motor Driven

| KW | Make | Speed |
|---|---|---|
| 1000 | G.E. | 900 |
| 500 | West. | 1100 |
| 300 | Elliott | 1200 |
| 300 | G.E. | 1200 |
| 300 | Al.Ch. | 1200 |
| 200 | G.E. | 1200 |
| 150 | West | 900 |
| 100 | Delco | 1200 |
| 75 | G.E. | 1200 |
| 50 | G.E. | 1200 |
| 40 | Rel.(4) | 1750 |
| 42 | ABC(2) | 1200 |
| 30 | G.E. | 1200 |
| 25 | G.E. | 1200 |

### GENERATORS 125 V. D.C. Motor Driven

| KW | Make | Speed |
|---|---|---|
| 250 | G.E. | 720 |
| 150 | Cr.Wh. | 1200 |
| 150 | West. | 1150 |
| 100 | West.(2) | 900 |
| 100 | G.E. | 1200 |
| 100 | El. Machry. | 1200 |
| 75 | Cr.Wh. | 1200 |
| 75 | Hertner | 1150 |
| 50 | Sturt. | 2800 |
| 35 | G.E. | 1750 |
| 35 | Ideal | 1200 |
| 30 | G.E. | 1150 |
| 30 | L.A. | 1450 |
| 25 | El. Machry.(2) | 1150 |

### GENERATORS Low Voltage D.C.

| Amp. | Make | Voltage |
|---|---|---|
| 8000 | H-V-W | 6/12 |
| 5000 | Optimus | 6/12 |
| 1500 | H-V-W | 6/12 |
| 125 | Hobart (8) | 7½ |
| 1000 | G.E. | 15 |
| 750 | Master | 20 |
| 1500 | Century | 24 |
| 550 | Col. | 27 |
| 100 | G.E. | 30 |
| 1000 | G.E. | 33 |
| 150 | Watton | 40 |
| 200 | G.E. | 42 |
| 1500 | G.E. | 50 |
| 1500 | Century | 60 |
| 1500 | G.E. | 60 |
| 1000 | G.E. | 75 |

### GENERATORS Diesel & Gasoline Driven

| Size | Make | Voltage |
|---|---|---|
| 100 KW | Superior | 250 D.C. |
| 100 KW | G.M. | 240 A.C. |
| 40 KW | Buda | 120 D.C. |
| 10 KW | Kohler | 220 A.C. |
| 5 KVA | Kohler | 115 A.C. |

4-1000 GPM Diesel Driven Pumps.

### TRANSFORMERS

4—333 KVA Moloney, 2300/4600 V. Primary, 230/460 V. Secondary.

1—300 KVA, Al. Ch. 3 ph, 11600 V. Primary, 230 V. Secondary.

1—300 KVA, Pittsburgh, 3 ph, 11600 V. Primary, 230 V. Secondary.

8—100 KVA West. 3 ph. 440-220 Dry.

2—50 KVA G.E.—H—KF, 2400/4160Y—120/240 V. Sec.

4—25 KVA West. 440 V. Primary, 110/220 V. Sec.

3—15 KVA West. 440 V. Primary, 110/220 V. Sec.

### MOTORS Squirrel Cage 3 Phase

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 500 | West.(2) | CS | 1160 |
| 450 | G.E.(vrt.) | KF-6338 | 1180 |
| 300 | G.E. | IK | 900 |
| 250 | G.E. | FT | 3560 |
| 250 | L.A. | OGS-1378 | 1150 |
| 200 | Wagner | RP2 | 1750 |
| 200 | G.E. | KF-6335 | 880 |
| 150 | West.(2) | CS | 1750 |
| 150 | West. | CS | 580 |
| 147 | West. | CS (25 cy.) | 715 |
| 125 | Al.Ch.(2) | AR | 435 |
| 100 | G.E. | K-544 | 1175 |
| 100 | West | CS | 870 |
| 100 | G.E.(2) | IK | 575 |
| 75 | West. | CCL | 1750 |
| 75 | G.E.(3) | K-565 | 1175 |
| 75 | G.E. | IK | 900 |
| 75 | G.E.(3) | KT-352 | 865 |
| 75 | West. | CS | 720 |
| 75 | G.E. | K-356 | 690 |
| 60 | Howell | SCR | 1800 |
| 60 | West.(2) | CS-607 | 880 |
| 60 | Rel.(2) | AA | 875 |
| 60 | G.E. | KT-346 | 865 |
| 50 | G.E. | FTR-523 | 3600 |
| 50 | Elliott | 196 | 3450 |
| 50 | West. | CS | 1740 |
| 50 | G.E. | KF-445 | 1170 |
| 50 | West. | CS-642C | 1160 |
| 50 | West.(3) | CS | 870 |
| 50 | G.E.(2) | IK | 870 |
| 50 | G.E. | FTR-542 | 870 |
| 50 | West. | CS | 690 |

### MOTORS Slip Ring 3 Phase

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 600 | Cr.Wh. | 131AQ | 507 |
| 225 | Wagner | 25 cy. | 710 |
| 200 | G.E. | MTP-557 | 1800 |
| 200 | G.E.(2) | IM | 1170 |
| 150 | Wagner | 31VRN | 900 |
| 150 | G.E. | MT-564Y | 580 |
| 100 | G.E. | MT-553 | 1165 |
| 100 | Al.Ch. | | 690 |
| 75 | G.E. | | 690 |
| 60 | West. | HF | 850 |
| 60 | Al.Ch. | | 690 |
| 50 | G.E. | MT-536 | 1150 |
| 50 | West. | CW | 1150 |
| 50 | G.E. | MT-336 | 1150 |
| 50 | F-M | BV | 600 |
| 50 | Al.Ch. | ARY | 575 |
| 50 | G.E. | IM | 490 |

### MOTORS Synchronous

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 475 | West. | | 720 |
| 400 | G.E.(2) | TS-9288 | 600 |
| 300 | G.E. | ATI | 900 |
| 260 | G.E. | TS | 900 |
| 200 | G.E. | TS | 1200 |
| 200 | G.E.(2) | 25 cy. | 500 |
| 200 | Ideal | SMW | 257 |
| 180 | G.E. | ATI | 900 |
| 160 | G.E. | TS | 1200 |
| 145 | G.E. | ATI | 720 |
| 135 | West. | G | 1200 |
| 135 | Ideal | | 1200 |
| 100 | Elec. Prods. | | 1200 |
| 55 | El. Machry. | BRKT | 1200 |

### MOTORS 550 V. D.C.

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 765 | G.E.(6) | MPC | 1045/1350 |

### MOTORS 230 V. D.C.

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 125 | G.E. | RC-15 | 1750 |
| 100 | G.E. | RC-14 | 1750 |
| 100 | Al.Ch. | | 1150 |
| 90/45 | G.E. | RF-17 | 950/475 |
| 75 | Sprague | | 1000/1500 |
| 75 | West.(2) | SK-180 | 475 |
| 75 | Cr.Wh. | LT | 480/670 |
| 75 | Cr.Wh. | CMC | 375/950 |
| 60 | West.(3) | SK-160 | 680 |
| 50 | G.E. | RC-12 | 1750 |
| 50 | Diehl | | 850/1050 |
| 45/90 | G.E. | RF-17 | 475/1950 |
| 25/75 | Cr.Wh. | CCM | 165/500 |
| 50 | West.(3) | SK 160 | 565 |
| 50 | G.E. | RF-17 | 250/1000 |
| 50 | West | SK | 250/1000 |
| 40 | West. | SK 103 | 1750 |
| 40 | Century | DN-454 | 1740 |
| 40 | G.E. | RC-31 | 1700 |
| 40 | G.E. | RC-32 | 1100 |
| 40 | G.E. | RC-34 | 750 |
| 40 | G.E.(2) | CD-1441 | 400/1500 |
| 40 | Cr.Wh. | CCM | 700 |
| 40 | Rel. | 461T | 400/1200 |
| 35 | West. | SK-120 | 1150 |
| 35 | G.E. | RLC | 440/800 |
| 30 | G.E.(8) | CDM-85 | 2200 |
| 30 | West. | SK | 975 |
| 30 | Cont. | D-103 | 850 |
| 30 | G.E. | RC-33 | 775 |
| 30 | West. | SA | 500/1500 |
| 30 | West.(2) | SK-143 | 575 |
| 25 | G.E. | RC-15 | 1750 |
| 25 | West. | SK-83 | 1750 |
| 25 | G.E. | *CDM-77 | 1750 |
| 25 | E.D. | 108 | 1800 |
| 25 | Rel. | 92T | 1150 |
| 25 | West. | SA | 500/1500 |
| 25 | West.(2) | SK-130 | 600 |
| 25 | G.E. | RF-14 | 300/1200 |

L. J. LAND INC. 40th

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Phone Liberty 2-4300

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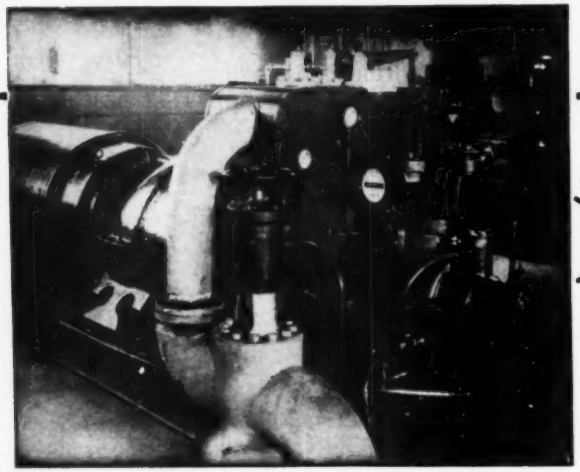


*Greater Values—Prompt Delivery*

## STRICTLY UTILITY, EFFICIENT WESTINGHOUSE CONDENSING STEAM TURBO-GENERATOR UNIT

**TURBINE**

1500 KW, 250 P.S.I., 150° S.H. 28 inch vacuum direct connected to:

**ALTERNATING CURRENT GENERATOR**

1875 KVA, 1500 KW, 80% P.F. 3 phase, 60 cycle, 2400 volt 451 Amp. complete and equipped with:

**ACCESSORIES**

2700 square foot Westinghouse surface condenser, condensing auxiliaries, piping, valves, duplicate exciter sets, switchboard panels and instruments.

EXCELLENT CONDITION

## TURBINE-GENERATOR UNITS

*3 phase, 60 cycle*

8250 KVA G.E. condens., 3 stage, 2300/4000 volts, 200# pressure, 600°TT, 3600 RPM.

5000 KVA G.E., non-cond. Automatic Extraction, 13,800 volts, 600# P.S.I., 750°TT 150# extraction and 25# gauge back.

3125 KVA G.E. condens. 130 P.S.I. 550 volts.

3125 KVA G.E. condensing 175/200 P.S.I. 2300 volt, 500°TT, 3600 RPM complete.

1875 KVA G.E. non-condensing 150# pressure, 30# gauge back, good for maximum 260#, 650°TT, 480 volts, 3600 RPM.

1563 KVA G.E. non-condensing 250 P.S.I. 25# gauge back, 2400 volts, 3600 RPM.

1563 KVA G.E. condensing 250 P.S.I. 2300 volts, 3600 RPM complete.

1560 KVA Allis condens. bleeder, maximum extraction 25,000# per hour, 240 volts.

925 KVA G.E. non-condensing 150 P.S.I. 15# gauge back, 480 volts, 3600 RPM.

625 KVA Westinghouse condensing 150/200# pressure, 2300 volt, 3600 RPM complete.

625 KVA G.E. non-condensing 150# pressure, 15# back, 2300 volts, 3600 RPM complete.

375 KVA (4) G.E. condensing 400# pressure, 480/2300/4150 volts complete.

180 KVA Westg. non-condensing 125 to 150 lbs. pressure, 10# gauge back, 2400 volts.

## TURBINE-GENERATOR UNITS

*Direct Current*

400 KW (2) 240 volts direct current Crocker-Wheeler Worthington 440 lbs. condens.

150 KW (2) 3 wire, 250 volts, 225/250 psi, Westinghouse-Worthington condensing.

75 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM, 150 lbs. pressure non-condensing.

60 KW (3) new Westinghouse 120 volt, 200# pressure, condensing.

## SYNCHRONOUS MOTORS

*3 phase, 60 cycle*

5000 KVA Westghse. 4000 volt, 720 RPM *synchronous condenser* complete.

900 HP Allis, 2200 volts, 150 RPM.

750 HP G.E. 2300 volt, 720 RPM.

300 HP 80% P.F. G.E., 2300 volts, 720 RPM.

## MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.

500 KW General Electric 600 volt DC, direct connected to 710 HP, 3 phase, 60 cycle, 2300 volt, 720 RPM synchronous motor.

400 KW General Electric 275 volt DC, direct connected to 710 HP, 3 phase, 60 cycle, 2300 volts, 720 RPM synchronous motor.

300 KW Allis-Chalmers, 250 volt DC generator direct connected to a 430 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1200 RPM synchronous motor.

150 KW G.E., 125 volt direct current generator direct connected 225 HP, 3 phase 60 cycle, 220 volt, 1200 RPM synchronous motor complete.

62½ KVA G.E., 3 phase, 60 cycle, 2300 volt, 1200 RPM alternator direct connected 75 HP, 125 volt DC motor.

## STEAM ENGINE-GENERATOR UNITS

*Direct Current*

400 KW G.E. 240 volts, 360 RPM generator connected Skinner Unaflow vertical engine, 150 lbs., 10 lbs. gauge back.

275 KW Westinghouse 250 volt, generator connected Ames vertical Unaflow engine.

250 KW (2) G.E. 250 volts generators connected Skinner Unaflow Engines.

200 KW, G.E. 125 volt, 200 RPM generator connected Skinner Unaflow engine.

100 KW Burke 3-wire, 250 volt generator connected Skinner Unaflow engine.

30 KW (2) G.E. 125 volts, 425 RPM generators each direct connected G.E. vertical engine 125 P.S.I.

## STEAM ENGINE-GENERATOR UNITS

*Alternating Current—3 Phase, 60 Cycle*

750 KVA G.E. 2300/480 volt, 150 RPM generator, connected Skinner Horizontal Unaflow non-condensing engine.

625 KVA Westge. 240 volts generator connected Skinner Unaflow Engine.

500 KVA G.E. 2300 volts generator connected Skinner Unaflow Engine.

500 KVA G.E. 240 volt, 360 RPM generator connected Skinner Vert. Unaflow engine.

375 KVA G.E. 2300/440 volts, generator connected 23"x24" Skinner Horizontal Unaflow. Engine 120 P.S.I.

175 KVA G.E. 240 volt generator connected Skinner Unaflow Engine.

## DIESEL ENGINES

900 HP (10) General Motors, Model 12-567 ATL, 12 cylinders, 744 RPM Diesels.

1200 HP (4) Fairbanks-Morse, 8 cylinders, opposed piston, 720 RPM Diesel engines.

### *NOVEMBER BARGAINS*

1—New 8400 sq. ft. Ingersoll-Rand Horizontal surface condenser.

1—4400 sq. ft. Worthington surface condenser.

4—900 KW, 250/375 volt, 720 RPM Elliott direct current generators direct connected 1200 HP, 8 cylinders Model #38D8⅛ opposed piston, 720 RPM Fairbanks-Morse Diesel Engines.

1—5425 GPM, 70 foot head Worthington Centrifugal pump direct connected to 125 HP G.E. Type MT-547, 3 phase 60 cycle, 2200 volt, 1750 RPM G.E. slip ring motor.

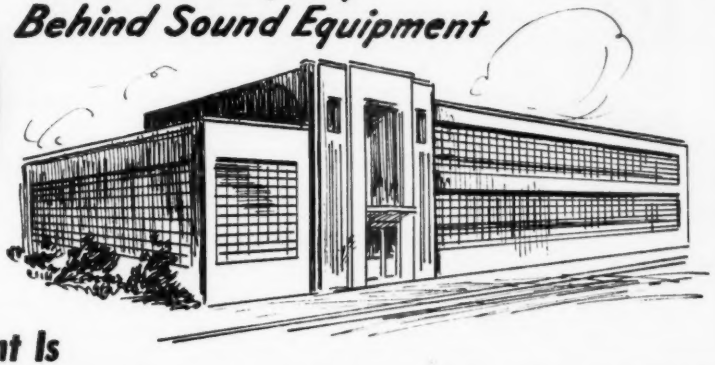
2—1000 GPM, 1270 foot head, 4-stage, Morris Machine Works pumps each direct connected to a 417 HP, 3-stage, Form D-54, 3100 RPM 390# pressure non-condensing G.E. steam turbine.

**UMC UTILITIES MACHINERY CORP.**

**1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422**

JLHCo

# A Sound Company Behind Sound Equipment



## Where Hemphill Electrical Equipment Is REBUILT — THEN TESTED BY ELECTRICAL ENGINEERS

● NO ITEM OF HEMPHILL REBUILT EQUIPMENT IS SHIPPED TO THE BUYER UNTIL TESTS PROVE THAT IT WILL GIVE YOU PERFECT SERVICE ●

### TRANSFORMERS

1—1000 KVA G.E., 3 Ph. auto 4150V.—2300V.
1— 500 KVA Kuhlman 4150 V Pri. 2300 V. Sec.
3— 400 KVA G.E., 6900 Primary—2300 Secondary
3— 300 KVA Pitts., 2300 V. Pri., 115/230 V. Sec.
3— 300 KVA, G.E., type H, 2300 V Pri., 115/230 V. Sec.
300 KVA, Pitts., 7200-440 v.
205 KVA, Whse., 2 ph., 2300 to 3 ph., 4150 auto.
200 KVA, 4000 v.—110/220
100 KVA, Pitts., 1375/2750 v. — 110/220.
3— 100 KVA G.E. 4150 volt 230/460 volt Pyranol
3— 100 KVA, Wagners, 240/120 v.—120 v.
2— 100 KVA, Newark, 440 v., 3 ph. to 220 v., 2 ph.
2— 100 KVA, Whse., 13800 v. to 250 v.
3— 75 KVA, G.E., 2400 v.—120/240
6— 50 KVA, Whse., 2400 v.—120/240 insetsen
6— 50 KVA Whse., 13,800 v. to 125 v. or 250 v.
6— 50 KVA, Whse., 6900 v. to 125 v. or 250 v.

### A. C. GENERATORS

2500 KVA, Whse., 8yn. Cond., 720 RPM, 2400 v.
500 KW, .8 P.F., 3600 RPM, ATB. 600 v.
320 KW, Allis, 450 RPM, 480 v.
240 KW, G.E., ATB, 600 RPM, 600 v.
200 KVA, Allis, 3600 RPM, 240 volt
200 KVA, Whse., 600 RPM, 240 v.
180 KW, Whse., 514 RPM, 550 v.
100 KW, G.E. ATB, 600 RPM, 240 v.
75 KW, Whse., 900 RPM, 220 v.
62½ KW, Allis, 3600 RPM, 220 v.
7— 50 KVA, Whse., 900 RPM, 220 v.
3— 35 KWA, Columbia, 1200 RPM, 240 v.
1— 31.3 KVA, America, 1200 RPM, 120/208.
15 KW, Star, 1800 RPM, 220/440.
12.5 KVA, Whse., 1200 RPM, 240 v.

### TURBINE BLOWERS

1—Spencer, 1000 cubic feet, 30 oz. pressure with a 15 H.P., 3600 RPM, General Electric Type FT 200 volt motor.
1—Bellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P. 3600 RPM. General Electric. Type K, 220 volt 3 phase motor.

### MOTORS, 3 Phase, 60 Cycles SQUIRREL CAGE

450 H.P., Ridgeway, 900 RPM, 2200 v.
125 H.P., G.E., KF, 1750 RPM, 2200 v.
125 H.P., U.S., 1200 RPM, Vert., 220 volts.
100 H.P., G.E., 400 RPM, 440 volt.
75 H.P., West., CS, 1750 RPM, 440 volts.
60 H.P. Whse., 900 RPM, Vert., 2200 volts.
60 H.P., Whse., 900 RPM, 440 volts.
2— 40 H.P., G.E., 900 RPM, 220 volts.
40/20 H.P., Westinghouse 600/450 440 volt.
35 H.P., Whse., 1200 RPM, CS, 2300 volts.

### MOTORS, 3 Phase, 60 Cycles SLIP RING

2500 H.P., G.E., 257 RPM, 6600 volts.
450 H.P., G.E., 425 RPM, ITC, 440 volts, 25 cycle.
2— 150 H.P., G.E., 1M, 440 volt, 450 RPM.
100 H.P., G.E., 1M, 440 volt, 25 cycle, 720 RPM.
1— 100 H.P., G.E., 1M, 440 V. 600 RPM.
75 H.P., Whse., CW, 720 RPM, 440 volt.
75 H.P., G.E., MT, 1200 RPM, Vert.
50 H.P., G.E., MT, 600 RPM, 220 volt.
2— 50 H.P., Whse., CW, 900 RPM, 220 volts.
40 H.P. Cont., 1200 RPM, JA85 220 volt.

### DIESEL GENERATOR SETS

1—300 KW 125/250 V. De La Vergne Baldwin 6 cyl. 4 cycle with Westinghouse generators

### LARGE STOCK OF D. C. MOTORS AND GENERATORS

### SYNCHRONOUS MOTORS

4—200/100 H.P., Whse., 720/360 RPM, 4150 v.
200 H.P., Whse., 600 RPM, 240 v.
1—200 H.P., G.E., 257 RPM, 440 volt
1—150 H.P., G.E., 1800 RPM, 220 v. TS
2—150 H.P., A.C. 360 RPM, 2200 V.
1—150 H.P., G.E., 720 RPM, 2200/440 volt
100 H.P., G.E., TS 900 RPM, 2200 V
75 H.P., G.E., 1200 RPM, 440 v.
70 H.P., Elect. Mach., 180 RPM 2200 v.
40 H.P., Whse., 1800 RPM, 220 v.
35 H.P., G.E., 1200 RPM, 2300 v.
20 H.P., Whse., 1800 RPM, 220 v.

### MOTOR GEN. SETS

1—1000 KW., Whse., 275 V.—1150—720 RPM, 8yn.
1—1000 KW. G.E., 600 volts—4150—514 rpm, 8in.
1— 400 KW. G.E., 250 V. 900 RPM 2300 V. 8yn.
1— 500 KW., G.E., 575 V. 900 RPM 2300 V. 8yn.
125 KW., CW, 125 v., 1200 RPM, 2300 v. sq. cage.
100 KW, El. Mach., 125 v., 1200 RPM, 4150 v. syn.
100 KW, G.E., 230 v., 900 RPM 4150 v. 8yn.
2— 75 KW., G.E., 125 v., 1200 RPM, 220/440 v.
6— 75 KW., G.E., 60 v., 1200 RPM 220/440 v.
50 KW., Ridgeway, 550 v., 1200 RPM, 220 v.
25 KW., G.E., ATI, 1800 RPM, 40 HP 1800 RPM, 230 v.

### PLATING M.G. SETS

250 Amp. G.E., 5/6 volt, 220 v.
500 Amp., Hansen Van Winkle, 24 volt 220/440 v.
2500 Amp., Chandeysson, 6/12 v., 400 RPM, 8yn., 440 v.
3000 Amp., Chandeysson 6/12, 400 RPM syn., 440 v.

### ENGINE GEN. SETS

150 KVA, G.E., Ames Uniflow, 220 v., 3 ph., non cond.
2— 5 KW, Gasoline, Hobart, 1800 RPM, 120 v., 1 ph. cond. engines.
1—200/275 H.P., Gasoline Engine, Van Bierck, 8 cylinder, 1500/900 rpm.

### TURBO GEN. SETS

625 KVA, Whse. 2400 v., 3 phase, non-con
300 KW, G.E., ATB, 240 v., 3 ph. cond.
60 KW, Whse., 120 v., D.C., cond.

### STEAM TURBINES

500 HP., G.E., 3 stage, 165#, 3240 RPM
800 HP., Terry Tandem type, 720 RPM rud. gear

**A GUARANTEE IS NO BETTER THAN THE COMPANY THAT GIVES IT — IT PAYS TO GET A *HEMPHILL* GUARANTEE**

JLHCo

THIS SEAL IS YOUR GUARANTEE

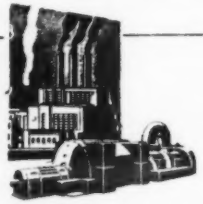
"FOR POWER"

J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600



**750 HP** 200#. Straight Tube Box Header. Ideal for sugar mill—lumber mill, etc. Four now available. Also Riley Stokers.

**3000 KW** 250# 500° TT. Operated at 200#. Automatic Extraction to 25,000#/hr. @ 10-25# g.
3400 KW max. straight condensing. 2400 volts. Built 1934.

**3500 KW** Wemco 46-CW. 200# 486° TT. Now arranged for non-automatic extraction @ 18# g. 2400 volts.

**300 KW** Kerr NC Turbo Generator. 165 ISP. 5-14# GBP. 60/3/240 volts. Complete. Built 1929.

**2000 KW** Allis Chalmers. 400# 650° TT. 2400/4160 volts. Complete. Built 1932. 20,000 log hours. 11#/KWH.

**600 KW** G.E. 200# ISP. 15# Automatic Extraction. 480 volts. Complete. Rewound 1940. Overhauled 1945. Price: $6,000.

**1500 KW** G.E. 240# 550°. 480 volts. Complete. Rewound and overhauled 1942. Near perfect condition.

**100 KW** G.M. Diesel. 60/3/450 volts. 1200 RPM. Heat exchanger cooling. Automatic start. Price: $6,300. each.

**1000 KVA** Synchronous Condenser. 2300 volts. With exciter and switchboard. Built 1929.

**190 HP** 3-drum boiler. New. Never Installed. C.E. Underfeed stoker. Hagen Controls. Replacement $14,000. Price: $10,000.

**FREQUENCY CHANGERS** 25 to 60 cycle. 625 — 1000 — 1875 — 2500 KVA.

# PAUL STEWART
## CINCINNATI, OHIO.

MAIN 5873 UNION TRUST BUILDING MAIN 3427

# IT'S EMPIRE FOR THE BEST

## NEW AND REBUILT ELECTRIC POWER EQUIPMENT

### Squirrel Cage Motors—3 Phase

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 250(2) | G. E. | KF559 | 1800 |
| 200(2) | G. E. | IK | 480 |
| 150(2) | G. E. | IK | 600 |
| 150 | West. | CS-856C | 900 |
| 150(3) | Century | SCN585W | 1200 |
| 150 | West. | CS | 1800 |
| 150 | G. E. | KT547S | 1800 |
| 125 | G. E. | K542Z | 1200 |
| 125 | Century | SCN584W | 1200 |
| 125(2) | G. E. | K546 | 1200 |
| 125 | G. E. | IK | 600 |
| 100 | Al. Ch. | | 720 |
| 100 | West. | CS762C | 900 |
| 100 | G. E. | KTP643 | 1800 |
| 100 | Cr. Wh. | CW35R | 1800 |
| 100(2) | West. | CS445 | 3600 |
| 75 | G. E. | IK | 450 |
| 75 | G. E. | IK | 514 |
| 75(5) | G. E. | IK | 600 |
| 75 | Fair. M. | BH24A | 600 |
| 75(2) | G. E. | KT556 | 720 |
| 75(3) | G. E. | IK | 720 |
| 75 | West. | CS | 720 |
| 75(6) | G. E. | IK | 900 |
| 75 | G. E. | KT352 | 900 |
| 75 | G. E. | KT552 | 900 |
| 75(2) | G. E. | KT347 | 1200 |
| 75 | Louis Allis | FAN505 | 1200 |
| 75 | Diehl | IS178 | 1200 |
| 75(2) | Al. Ch. | AR | 1800 |
| 75(2) | G. E. | KT537 | 1800 |
| 75 | Louis Allis | FAN505 | 1800 |
| 75 | G. E. | IK | 1800 |
| 60 | G. E. | KT552 | 720 |
| 60 | West. | CS646A | 900 |
| 60 | Wagner | BR | 1200 |
| 60 | G. E. | KT333 | 1800 |
| 50 | Reliance | IQ | 514 |
| 50(5) | West. | CS762C | 600 |
| 50 | G. E. | KT552 | 600 |
| 50(2) | Al. Ch. | AR | 600 |
| 50(2) | G. E. | KT352 | 720 |
| 50 | G. E. | IK | 720 |
| 50 | Fair. M. | H162 | 720 |
| 50(2) | G. E. | KT546 | 900 |
| 50(2) | G. E. | KT542 | 900 |
| 50 | West. | CS644C | 900 |
| 50 | Wagner | RP5-505 | 900 |
| 50(3) | West. | CS642C | 1200 |
| 50 | G. E. | FTR546 | 1200 |
| 50 | West. | CS587C | 1800 |
| 50 | G. E. | KT527 | 1800 |
| 50 | Cr. Wh. | 15R | 1800 |
| 50 | Al. Ch. | ARWWX-444S | 3600 |

### Synchronous Motors—3 Phase

| | | | |
|---|---|---|---|
| 350 | G. E. | ATI | 600 |
| 300 | G. E. | TS-974T | 720 |
| 220 | G. E. | ATI-PM | 600 |
| 200 | G. E. | ATI-6304D | 257 |
| 150 | G. E. | TS-7641 | 720 |
| 145(3) | West. | 6C1288 | 1200 |
| 108(2) | G. E. | TS954Y | 1200 |
| 75 | G. E. | ATI-PC | 900 |
| 60 | G.E. | TS-7536 | 1200 |
| 50(3) | Elec. Machy. | | 225 |
| 50 | G. E. | TS-945 | 900 |
| 35(4) | G. E. | TS-523 | 1800 |
| 220 | G. E. | AQI-PB (2 Ph.) | 600 |

### Squirrel Cage Motors—2 Phase

| | | | |
|---|---|---|---|
| 50(4) | West. | CS | 1200 |
| 40 | West. | CS | 1200 |
| 30 | West. | CS | 720 |
| 25 | Fair. M. | H12B | 900 |
| 25 | West. | CS | 1750 |
| 20 | West. | CS-644 | 900 |
| 20 | G. E. | KQ-302 | 1200 |
| 20 | G. E. | K-364 | 1800 |

### 3 Phase—25 Cycle—Motors

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 200 | G. E. | IM | 720 |
| 150 | West. | HF | 360 |
| 150 | G. E. | IK | 720 |
| 100 | G. E. | IM | 485 |
| 100 | G. E. | MTC5353 | 750 |
| 100 | Lincoln | IQ | 750 |
| 100 | West. | CS (Gear Hd.) | 900 |
| 75 | G. E. | IK | 500 |
| 75 | G. E. | IK | 750 |
| 75 | West. | CW-773C | 750 |
| 50 | Century | SC50 | 750 |
| 50 | Burke | N-506S | 1500 |
| 40(2) | G. E. | MTC-5333 | 750 |
| 30 | Lincoln | 1XM | 500 |
| 30 | G. E. | KT527Y | 1500 |
| 25 | G. E. | MTC5323 | 750 |
| 20 | Century | SC30 | 750 |
| 20 | West. | CS583C | 750 |
| 20 | Wagner | BR | |

### Slip Ring Motors—3 Phase

| | | | |
|---|---|---|---|
| 450 | West. | CW | 500 |
| 300 | G. E. | MTC5566Z | 600 |
| 275 | G. E. | I | 360 |
| 150 | Al. Ch. | ANY | 600 |
| 150 | Fair. M. | HV-Z20C | 1800 |
| 125 | G. E. | MT-562 | 600 |
| 100 | G. E. | IM | 1800 |
| 75 | Al. Ch. | ANY | 600 |
| 60 | G. E. | MTC-5546 | 600 |
| 60 | G. E. | MT-546 | 900 |
| 52 | Otis | 35A | 720/240 |
| 50 | G. E. | IM | 450 |
| 50 | G. E. | IM | 720 |
| 50 | G. E. | MT-552 | 720 |
| 50 | G. E. | MT-542 | 900 |
| 50 | G. E. | IM | 900 |
| 50 | Ideal | A-328-25 | 900 |
| 50 | Cr. Wh. | 122Q | 900 |
| 50(2) | Imperial | W-55 (Hoist D) | 900 |
| 40 | G. E. | MT-346 | 720 |
| 40 | Ideal | AV-24-325 | 900 |
| 40 | West. | CW | 900 |
| 40 | West. | MT-342 | 900 |
| 40(9) | G. E. | MTC-5522 | 1200 |
| 40 | G. E. | IM | 600 |
| 35 | G. E. | IM | 720 |
| 35(2) | Ideal | AV-A306-22 | 900 |
| 30 | G. E. | MT536 | 900 |
| 30 | West. | CW-687C | 1200 |
| 25(3) | G. E. | MT-342 | 600 |
| 25 | G. E. | IM | 600 |
| 25(2) | Al. Ch. | ARY | 900 |
| 25 | G. E. | MT326 | 900 |

### Slip Ring Motors—2 Phase

| | | | |
|---|---|---|---|
| 150 | G. E. | MQP549 | 1800 |
| 52 | G. E. | IQC5012 | 900 |
| 50(6) | Al. Ch. | ANY 26C | 900 |
| 50 | G. E. (Vertical) | MQ836 | 1200 |
| 40 | Al. Ch. | ARY | 720 |
| 30 | Al. Ch. | ARY-220C | 900 |
| 25 | Al. Ch. | ARY | 600 |
| 25 | Al. Ch. | ARY220C | 900 |
| 25 | G. E. | MQ826 | 1200 |
| 15 | Al. Ch. | ARY | 720 |
| 15 | Ideal | AV-A120-18 | 900 |
| 15 | Wagner | 19TBR | 900 |
| 10(8) | G. E. | MQ526 | 600 |

PARTIAL LIST ONLY

### 230 Volt—DC—Motors

| | | | |
|---|---|---|---|
| 150(3) | Cr. Wh. | 85H(TEFC) | 900 |
| 150 | G. E. | CDP125 | 1800 |
| 135 | Burke | WAM-15 | 1200 |
| 112(4) | Cr. Wh. | HHL | 1750 |
| 100 | G. E. | CDM1339Y | 1200 |

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 100 | Elec. Dynamic | 10SM | 1800 |
| 90 | West. | SK-1-83-H | 575 |
| 62½(3) | West. | SK123L | 1750 |
| 60(2) | G. E. | CDM-95 | 1800 |
| 59(2) | G. E. | CO-2007 | 470 |
| 50 | West. | CK9 | 600 |
| 50 | West. | SK220 | 94/170 |
| 50 | G. E. | RLC204 | 500/1500 |
| 50(12) | Burke | WA6S | 1450 |
| 40 | Cr. Wh. | 50H | 750/1000 |
| 40(4) | Cr. Wh. | EH-M | 1800 |
| 40 | Century | DN454 | 1800 |
| 35 | G. E. | RLC | 650/1300 |
| 30 | Reliance | 310T | 400/1600 |
| 30 | Al. Ch. | EB-127S | 600/2400 |
| 30(3) | Al. Ch. | E-122 | 850 |
| 30 | G. E. | RC12 | 1150 |
| 30(2) | G. E. | CDM85 | 2200 |
| 27½ | Elec. Dynamic | 15S | 450/1350 |
| 25 | West. | SK183 | 160/240 |
| 25 | G. E. | CD128Y | 200/180 |
| 25(3) | G. E. | CO1809 | 500/2100 |

PARTIAL LIST ONLY

### 115 Volt—DC—Motors

| | | | |
|---|---|---|---|
| 100 | G. E. | CDM1242Y | 1200 |
| 80 | Cr. Wh. | CMC-50H | 1200 |
| 65 | G. E. | CDM-1135Z | 1200 |
| 60 | Cr. Wh. | CMC125H | 240/300 |
| 25 | G. E. | RC81B | 1200 |
| 15 | West. | CK7 | 850 |
| 15 | West. | SK83 | 1200 |
| 15 | G. E. | RC29A | 1750 |
| 15 | Elec. Specialty | U53 | 1750 |
| 15(2) | West. | SK | 1750 |
| 14/17 | G. E. | RA30 | 1650/2100 |
| 10 | G. E. | RC29 | 850 |
| 10 | G. E. | RC29A | 1150 |
| 10 | West. | SK70L | 1750 |
| 10 | West. | SK53 | 1750 |
| 10 | G. E. | CD73 | 1750 |
| 7½ | G. E. | CDM | 850/2300 |
| 7½ | West. | SK60L | 850 |
| 7½ | Cr. Wh. | CCM | 850 |
| 7½ | G. E. | CDM75 | 850 |
| 7½ | West. | SK40 | 1150/1725 |

PARTIAL LIST ONLY

**SPECIAL**

**3—150 100 75/50 H.P.—3/60/440 v. 1800/1200/900/600 RPM—G. E.—KT559AS—BB DP—motors with CR-7950Y1 controls.**

**SPECIAL**

**WRITE FOR OUR COMPLETE STOCK LIST OF TRANSFORMERS OFFERED AT EXTREMELY LOW PRICES.**

**AC and DC GENERATORS and Motor Generators, in practically all voltages and sizes.**

## EMPIRE ELECTRIC COMPANY, INC.

**87-93 JAY STREET** **PHONE MAIN 4-5900** **BROOKLYN 1, NEW YORK**

# POWER EQUIPMENT—READY TO SHIP

## A.C. MOTORS—3 PH. 60 CY.

| No. | H.P. | Make | Type | RPM | Volts |
|---|---|---|---|---|---|
| 2 | 300 | G.E. | I | 1150 | 2200 |
| 1 NEW | 200 | Westg. | Syn | 1200 | 220/440 |
| 2 Vert. | 250 | G.E. | | 1200 | 2200 |
| 2 | 250 | G.E. | I | 1150 | 2300 |
| 2 | 200 | G.E. | I | 860 | 2200 |
| 1 | 200 | Westg. | CS | 900 | 2300/4000 |
| 1 | 200 | G.E. | Syn. | 1800 | 2300/550 |
| 1 | 175 | Westg. | MS | 1200 | 550/440 |
| 1 | 150 | Westg. | Syn. | 257 | 240/480 |
| 1 | 150 | Westg. | CO-956A | 580 | 4000/2300 |
| 1 | 150 | Westg. | Syn. | 600 | 220/440 |
| 1 NEW | 150 | Elec. Mach. | | 720 | 4160/2300 |
| 1 | 150 | Westg. | Syn. | 900 | 2300 |
| 1 | 150 | Westg. | Hi-torq. | 1200 | 220 |
| 3 | 150 | Louis Allis | FX | 1775 | 220/440 |
| 1 | 150 | Westg. | CS | 720 | 4000/2300 |
| 1 | 125 | Elec. Mach. | Syn. | 164 | 220/440 |
| 1 NEW | 125 | Elec. Mach. | | 585 | 4160/2300 |
| 1 | 125 | G.E. | IK | 900 | 220/440 |
| 1 | 125 | Westg. | CS | 690 | 220/440 |
| 1 | 125 | Westg. | Hi-torq. | 1115 | 220/440 |
| 1 | 125 | Westg. | CS | 3600 | 220/440 |
| 3 | 113 | Westg. | Syn. | 1200 | 220/440 |
| 1 | 100 | Reliance | | 495 | 220/440 |
| 1 | 100 | Westg. | | 580 | 220/440 |
| 1 | 100 | G.E. | | 600 | 220/440 |
| 1 | 100 | G.E. | IK | 720 | 220/440 |
| 1 | 100 | Allis Chal. | | 720 | 220/440 |
| 1 | 100 | G.E. | I-K | 900 | 900/440 |
| 1 | 100 | Westg. | Hi-torq. | 830 | 220/440 |
| 1 | 100 | Westg. | Syn. | 900 | 220/440 |
| 1 | 100 | Armour | AB | 1750 | 220/440 |
| 1 | 100 | Louis Allis | GGS | 1750 | 220/440 |
| 1 | 90 | G.E. | I-K | 600 | 220/440 |
| 1 | 75 | Stanley | | 600 | 220/440 |
| 1 | 75 | Allis Chal. | | 585 | 220/440 |
| 1 | 75 | Westg. | CS | 860 | 220/440 |
| 1 | 75 | G.E. | I-K | 900 | 220/440 |
| 1 | 75 | G.E. | I | 720 | 220/440 |
| 1 | 75 | Elec. Mach. | Syn. | 900 | 220/440 |
| 1 | 75 | Louis Allis | GGS | 1200 | 220/440 |
| 1 | 75 | Burke | | 1200 | 220/440 |
| 1 | 75 | Louis Allis | FAA | 1150 | 220/440 |
| 1 | 75 | G.E. | KT | 1150 | 220/440 |
| 3 tefc | 75 | Master | PA | 1750 | 220/440 |
| 1 tefc | 75 | Westg. | CS | 1750 | 220/440 |
| 1 | 60 | Allis Chal. | | 514 | 220/440 |
| 1 | 60 | G.E. | I-K | 600 | 220/440 |
| 1 | 60 | Burke | | 900 | 220/440 |
| 1 | 60 | G.E. | | 900 | 220/440 |
| 1 | 60 | Triumph | | 1200 | 220/440 |
| 1 | 60 | G.E. | KT | 1150 | 220/440 |
| 2 | 50 | G.E. | KT | 720 | 220/440 |
| 1 | 50 | Cr. Wh. | | 900 | 220/440 |
| 1 | 50 | Wagner | | 900 | 220/440 |
| 1 | 50 | Triumph | B | 860 | 220/440 |
| 2 | 50 | G.E. | KF | 860 | 220/440 |
| 2 | 50 | Westg. | CS | 860 | 220/440 |
| 1 | 50 | G.E. | KT | 1200 | 220/440 |
| 1 | 50 | Wagner | CP | 1750 | 220/440 |
| 1 | 40 | G.E. | KT | 770 | 220/440 |
| 2 | 40 | Westg. | CS | 885 | 220/440 |
| 1 | 40 | Cr. Wh. | | 720 | 220/440 |

## SPECIAL BARGAINS
### Diesel Engine Generator Sets

11—100 KW., 120/240 V.D.C. Delco Generators dir. con. to 150 HP., Model GBD-8, 5½x7, 8 cyl, Superior Diesel Engines, elec. start, power panel, accessories. Practically new—only used for spares

4—100 KW., 220/440 V. A.C. 3 ph. 60 cy. West. Gen. dir. con. to 150 HP. Superior Diesels same as above

2—100 KW., 220/440 V. A.C. 3 ph. 60 cy. West. dir. con. 150 HP. General Motors DIESEL Model 3-268A, 3 cyl.

2—75 kva. 220/440 V. A.C. 3 ph. 60 cy. Delco dir. con. Cummins Diesel engines

2—37½ kva. 220/440 V. A.C. 3 ph. 60 cy. dir. con. Buda Diesel Engines

1—NEW 7½ kva. 120/V. 3 ph. 60 cy. Wisconsin GASOLINE

10—3 kva. 120 V. single or 3 phase, 60 cy. Hobart A.C. Generators dir. con. to Hercules GASOLINE ENGINES with panels

## SLIP RING MOTORS—3 ph. 60 cy.

| No. | H.P. | Make | RPM | Volts |
|---|---|---|---|---|
| 2 | 800 | West. CW | 507 | 6600 |
| 1 | 200 | West. CW | 1800 | 220/440 |
| 1 | 150 | West. CW | 1150 | 2200/220/440 |
| 1 | 125 | West. CW | 860 | 2200/220/440 |
| 1 | 100 | West. CW | 720 | 2200/220/440 |
| 1 | 100 | Triumph C-17 | 580 | 550/440/220 |
| 1 | 75 | G.E.I-M | 720 | 220/440 |
| 1 | 75 | West. CW | 1800 | 220/440 |
| 1 | 60 | West. CW | 900 | 220/440 |
| 1 | 60 | G.E. | 870 | 220/440 |
| 1 | 60 | Burke | 1200 | 220/440 |
| 1 | 60 | G.E. 1M | 720 | 220/440 |
| 4 | 50 | West. CW | 870 | 2300/220/440 |

## VARIABLE SPEED MOTORS—230 V. D.C.

| No. | H.P. | Make | Type | RPM |
|---|---|---|---|---|
| 1 | 200 | Westg. | SK-210 | 500/2000 |
| 2 | 200 | Reliance | 1970-T | 400/1200 |
| 1 | 100 | Westg. | SK-190 | 500/1000 |
| 1 | 100 | Westg. | SK | 600/1200 |
| 1 | 75 | Westg. | SK | 1100/1800 |
| 2 | 75 | Westg. | SK | 850/1700 |
| 1 | 75 | Westg. | SK-151 | 250/1000 |
| 1 | 60 | Westg. | SK-150 | 875/1750 |
| 1 | 50 | Westg. | SK-151 | 250/1000 |
| 1 | 50 | Westg. | SK-191 | 350/1050 |
| 1 | 50 | Westg. | SK-143 | 850/1750 |
| 1 | 40 | Cr. Wh. | CMC | 500/1500 |
| 1 | 20 | Westg. | SK-123 | 400/1600 |

## AXIAL FLOW VENTILATING FANS

25—6000 cfm Sturtevant Bulletin 512389, 3" stat. pres. 7 blade, dir. con. 5/1.5 HP., 1765/1175 rpm., 220/440 v. 3 ph. 60 cy. West. TEFC Motors.

## A. C. GENERATORS—3 ph. 60 cy.

| No. | KVA. | Make | RPM | Volts |
|---|---|---|---|---|
| 1 new | 250 | Westg. | 1200 | 220/440 |
| 1 New | 200 | West. | 1200 | 220/440 |
| 4 New | 100 | West. | 1200 | 220/440 |
| 1 | 100 | Elec. Mach. | 164 | 220/440 |
| 1 | 100 | Westg. | 600 | 220/440 |
| 1 | 75 | Elec. Mach. | 900 | 200/440 |
| 10 New | 37½ | West. | 900 | 220/440 |
| 11 New | 25 | West. (single Phase) | 900 | 120 |

## MOTOR GENERATOR SETS—250 V.D.C.
### Motors 220/440 volt or 2200 volt 3 phase, 60 cycle

| No. | KW | Make | RPM |
|---|---|---|---|
| 3 | 250 | Westinghouse | 1200 |
| 1 | 200 | Westinghouse | 720 |
| 2 | 200 | Westinghouse | 1200 |
| 1 | 100 | Westinghouse | 700 |
| 1 | 100 | General Electric | 900 |
| 1 | 100 | Westinghouse | 600 |
| 1 | 100 | General Electric | 1800 |
| 1 | 100 | Reliance | 580 |
| 1 | 100 | Delco | 1200 |
| 2 | 90 | Westinghouse | 680 |
| 4 | 75 | Westinghouse | 720 |
| 1 | 75 | Westinghouse | 1200 |
| 1 | 60 | Westinghouse | 1200 |
| 1 NEW | 50 | General Electric | 1800 |
| 3 | 40 | Westinghouse | 900 |
| 2 | 30 | Westinghouse | 720 |

### 125 V. DC M.G. Sets

1—100 kw. G.E. 125 v. 900 rpm. 220/440 v. 3 ph. 60 cy. AC Syn.

1—75 kw. West. 125 v. 1200 rpm. 220/440 v. 3 ph. 60 cy. Syn.

## ENGINE GENERATOR SETS

1—125 kva. 220/440 v. 3 ph. 60 cy. 257 rpm. Erie Ball STEAM.

1—125 kva. G.E. 220/440 v. 3 ph. 60 cy., dir. con. Skinner UNIFLOW Engine.

## BRAND NEW TURBO SET

Westinghouse Steam Turbine consisting of 200 kw., 220/440 v., 3 ph. 60 cy. 1200 rpm., 80% P.F. A.C. Generator—40 kw., 120 v. 1200 rpm., D.C. Exciter and Westg. Reduction Gear.—Non-cond.

## SPECIAL BARGAIN AIR COMPRESSOR

6—240 CFM Westinghouse type 3 VS-Z3 3 cyl. vert., 150 lbs. pres. dir. con., to 50 HP., 220/440 or 2200 v. 3 ph. 60 cy. West Slip Ring Motors, auto. control. Can furnish D.C. Motors or Oil or Gasoline Engines if desired.

***WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.***

## Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

# FOR SALE
# POWER GENERATING PLANT

***Modern & Complete***

1—60,000 lbs. per hour Steam Generator, built by Combustion Engineering Co. Built 1945 for 250 p.s.i. equipped with water walls, Elesco Superheater, Cox type Traveling Grate Stoker, draft fans, soot blowers, etc.

1—70,000 lbs. per hour Steam Generator, built by Edgemoor Iron Works for 225 p.s.i. Now insured for 225#. Equipped as above.

1—1000 KW Turbo Generator Set, Westinghouse E.&M. Co., non-condensing, 3/60/2300V.

1—750 KW Turbo Generator Set, Westinghouse E. & M. Co., Bleeder Condensing type, high pressure 185#, 25 lbs. gauge bleeder pressure, 3/60/2300V. With Westinghouse low level Jet Condenser, Air Ejector, Full Switchboard, etc.

*Complete specifications and quotation on request.*

**CONSOLIDATED PRODUCTS CO., INC.**
**14-17 PARK ROW** **NEW YORK 7, N. Y.**

# BOILERS

10 to 1000 H. P.
NEW-USED
RECONDITIONED
*Steam, Gas and Electric Power Equipment*

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

# MODERN DIESEL GENERATING PLANTS

450 HP Fairbanks-Morse Diesel Engine, 6 cylinder, series 32-E-14, 300 RPM, direct connected to 300 KW Fairbanks-Morse generator, 240 volt, 3 phase, 60 cycle.

300 HP Fairbanks-Morse Diesel Engine, 4 cylinder, series 32-E-14, 300 RPM, direct connected to 200 KW Fairbanks-Morse generator, 240 volt, 3 phase, 60 cycle.

30 KW Ready-Power Portable generator sets.

**DENNY & CLARK**
**1923 W. North Ave., Chicago 22, Ill.**

# The Boston Metals Company

DIESEL ENGINES
DIESEL GENERATORS
LST and LIBERTY MACHINERY
GENERAL MARINE EQUIPMENT
ALL PROPERLY WAREHOUSED

**LOW PRICES — HIGH QUALITY**
IMMEDIATE DELIVERY

## DIESEL ENGINES

(2)—MODEL 12-567—G.M. DIESEL ENGINES: 8½ x 10 — two cycle — 900 HP — 744 R.P.M.—Complete with Falk Reduction Gears — Excellent Condition — INDEPENDENT SURVEYORS REPORTS AVAILABLE—Right hand engines.

(2)—900 H.P. DIRECT REVERSIBLE, ALCO DIESEL ENGINES: 6 cylinder—12½ x 13 —700 R.P.M.—Model 540—Air Starting —Turbo charged—4 cycle—Hydraulic Coupling—Reduction Gears—2.0377 to 1—Mfg. by Farrell.

(2)—1600 H.P.—G.M. DIESEL ENGINES—MODEL 16-278A: 8¾ x 10½—2 cycle—750 R.P.M.—Air Start—Serials 11907 and 11909—Left Hand rotation—Practically new.

(1)—96 H.P. — BUDA DIESEL ENGINE—MODEL 6DTG: 6 cylinder—New.

## DIESEL GENERATORS

(1)—100 K.W.—3-268A—G.M. DIESEL GENERATOR: Engine G.M. Model 3-268A—6½ x 7—1200 R.P.M., Generator: Century 440/3/60 A.C.

(5)—100 K.W.—D.C.—DIESEL GENERATORS WITH SWITCHGEAR: Superior GBD-8—150 H.P.—8 cylinder—5½ x 7—Delco Gen. 120/240 volts—417 amps.—Condition, excellent.

(1)—30 K.W.—BUDA DIESEL GENERATOR—120 volts, D.C.

(2)—15 K.W. SHEPPARD DIESEL GENERATOR—120 volts, D.C.

(1)—15 K.W.—FAIRBANKS MORSE—DIESEL GENERATORS: 3 cylinder — Radiator cooled 120/240 volts—1200 R.P.M.—Factory reconditioned.

(2)—10 K.W. 120 Volt Diesel Generators.

## TURBO GENERATORS

60 K.W.—D.C. Westinghouse—500 amps.—120 volts.

150 K.W.—D.C. Westinghouse—Worthington —120 volts.

## CARGO WINCHES

5 Ton Capacity—7 by 10 Clyde Iron Works — single drum. Fabricated base — cargo winch.

## DIESEL PUMPS—1000 G.P.M.

BUDA DIESEL—6 Cyl. 1850 R.P.M. Goulds Pump—1000 G.P.M.—280' head mounted on steel base. Electric starting—pump bronze.

WRITE — WIRE — PHONE
Curtis 5050, 5051, 5052

**THE BOSTON METALS CO.**
313 EAST BALTIMORE ST.
BALTIMORE, MD.



# ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

## PROMPT SHIPMENT — PARTIAL LISTING

### VARIABLE VOLTAGE DRIVES

60 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 600/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

### SLIP RING MOTORS—3 Ph., 60 Cy.

| Qn. | H.P. | Speed | Volts | Make | Type |
|---|---|---|---|---|---|
| 6 | 7½ | 870 | 550 | G.E. | MTC-5201 |
| 1 | 7½ | 575 | 220 | G.E. | MT-522 |
| 2 | 10 | 1140 | 440 | West. | HF-7A |
| 3 | 10 | 570 | 220 | G.E. | HI-11 |
| 2 | 11‡ | 870 | 550 | G.E. | TTC-5008 |
| 2 | 15 | 1160 | 440 | West. | CW-464C |
| 2 | 15 | 570 | 220 | West. | CW-846 |
| 1 | 15 | 880 | 440 | West. | MW-316 |
| 1 | 20 | 880 | 440 | West. | CW-538 |
| 1 | 25 | 1130 | 550 | G.E. | MT-323 |
| 2 | 25 | 850 | 220 | Wagner | WR |
| 1 | 25 | 720 | 440 | Wagner | 22VRR |
| 1 | 30 | 885 | 440 | West. | CW-646 |
| 1 | 30 | 850 | 440 | G.E. | MT-322 |
| 1 | 30 | 575 | 440 | G.E. | MT-358 |
| 2 | 35 | 600 | 440 | F-M | HV-H16A |
| 3 | 40 | 885 | 2200 | Al-Ch. | ARY-223C |
| 1 | 40 | 880 | 440 | G.E. | MT-546 |
| 2 | 50 | 1150 | 440 | G.E. | M-536 |
| 1 | 50 | 880 | 440 | West. | HF-12A |
| 1 | 50 | 570 | 440 | G.E. | MT-552 |
| 5 | 52‡ | 850 | 220 | G.E. | TQC-5013*** |
| 1 | 60 | 688 | 440 | West. | CW-758 |
| 1 | 60 | 870 | 550 | G.E. | MTC-5546 |
| 1 | 60 | 345 | 550 | West. | CW-938 |
| 1 | 80‡ | 575 | 440 | G.E. | MTC-8352 |
| 2 | 125 | 430 | 440 | G.E. | IL-18 |
| 1 | 150 | 1750 | 440 | G.E. | MTP-549 |
| 1 | 175 | 505 | 550 | West. | CW-1002 |
| 2 | 200 | 600 | 550 | G.E. | IM-17 |
| 1 | 200 | 495 | 2200 | G.E. | IM-17A |
| 3 | 300 | 900 | 440 | G.E. | IM-17 |
| 2 | 300 | 880 | 2200 | G.E. | IM-17A |
| 4 | 350 | 1775 | 2300 | G.E. | IM-E15A |
| 2 | 350 | 880 | 2200 | G.E. | IM-17A |
| 1 | 400 | 505 | 550 | West. | CW |
| 1 | 600 | 1770 | 440 | G.E. | IM-E15C |
| 1 | 650** | 360 | 440 | G.E. | MT-442Y |
| 1 | 700 | 735 | 4600‡‡ | West. | CW |

220 volt motors can be reconnected for 440 volts.
‡Intermittent rating. ***2 phase.
**New. ‡225 Cycle.

### 230 VOLT CONST. SPEED D. C. MOTORS

| Qn. | H.P. | Speed | Make | Type |
|---|---|---|---|---|
| 20 | 2 | 850 | West. | BK-20 |
| 7 | 3** | 1150 | Al-Ch. | EB-71 |
| 10 | 3 | 850 | Reliance | Y-23T |
| 25 | 3½ | 850 | West. | BK-30 |
| 1 | 7½ | 1150 | G.E. | CDM-56 |
| 3 | 7½ | 850 | G.E. | CD-75 |
| 10 | 10** | 1750 | Kimble | BA-324 |
| 5 | 10*** | 1150 | Al.-Ch. | EB-80 |
| 2 | 10 | 850 | West. | BK-83 |
| 10 | 13½** | 600 | West. | BK-93 |
| 3 | 15 | 1750 | G.E. | CD-75 |
| 5 | 15 | 825 | West. | BK-90 |
| 1 | 20 | 1750 | L.A. | ONA-L851 |
| 1 | 20 | 1750/1310 | West. | BK-83 |
| 2 | 20 | 1150 | G.E. | RC-30 |
| 11 | 20 | 750 | West. | BK-110L |
| 17 | 25 | 825 | West. | BK-120 |
| 1 | 30 | 1160 | G.E. | RC-12 |
| 1 | 40 | 1700 | West. | BK-103 |
| 1 | 40 | 750 | G.E. | RC-34 |
| 1 | 50 | 750 | West. | BK-150 |
| 1 | 60 | 650 | G.E. | RC-15 |
| 1 | 60 | 1750/1310 | West. | BK-143 |
| 1 | 150 | 700 | Al.-Ch. | |
| 2 | 200 | 1150 | G.E. | RC-38 |
| 1 | 250 | 1150 | C.W. | CMC-101A |

### 230 VOLT ADJ. SPEED D.C. MOTORS

| Qn. | H.P. | Speed | Make | Type |
|---|---|---|---|---|
| 10 | 1½/2 | 600/2000 | G.E. | CD-65 |
| 1 | 2 | 225/900 | Reliance | 7ST |
| 1 | 5 | 450/1800 | G.E. | CD-83 |
| 2 | 6 | 450/1800 | G.E. | RF-9 |
| 6 | 5/7½ | 600/1800 | G.E. | KA-30 |
| 1 | 10 | 400/1600 | Reliance | T-92T |
| 2 | 10/15 | 600/2400 | Reliance | T-92T |
| 1 | 12½ | 280/840 | West. | SK-130 |
| 10 | 13¾** | 600 | West. | SK-93 |
| 1 | 15 | 600/1200 | West. | SK-100L |
| 1 | 20 | 500/1500 | G.E. | 3AF-11 |
| 1 | 20/25 | 400/1600 | Reliance | T-220-T |
| 1 | 20/25 | 300/1200 | West. | SK-153 |
| 1 | 25 | 400/1600 | G.E. | RF-13 |
| 1 | 25 | 500/1500 | G.E. | RF-12 |
| 1 | 25/29 | 300/1200 | G.E. | RF-13 |
| 1 | 30 | 400/1200 | West. | SK-163 |
| 1 | 30/40** | 400/1600 | G.E. | CD-1236 |
| 1 | 35 | 500/1500 | West. | SK-143 |
| 1 | 40/50 | 400/1200 | Reliance | T-461-T |
| 1 | 75 | 500/1500 | Cr.-Wh. | CCM |
| 1 | 75 | 375/750 | Cr.-Wh. | CMC-125H |
| 2 | 100 | 225/900 | G.E. | MPC-A |
| 5 | 100 | 400/1200 | Al.-Ch. | |
| 1 | 100 | 330/900 | West. | SK-200 |
| 1 | 125 | 450/1000 | West. | SK-190 |
| 1 | 175 | 250/500 | West. | SK-220 |
| 2 | 375 | 350/500 | G.E. | MPC |

**New

### SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

**Totally Enclosed Fan Cooled, Ball Bearing**

| Qn. | H.P. | RPM | Volts | Make | Type |
|---|---|---|---|---|---|
| 1 | 5 | 3480 | 220 | G.E. | K-225 |
| 2 | 5 | 1750 | 440 | L.A. | JA-254 |
| 10 | 5 | 1730 | 440 | G.E. | K-254 |
| 2 | 5 | 1165 | 440 | L.A. | JA-284 |
| 5 | 7.5 | 1740 | 440 | G.E. | K-284 |
| 1 | 10 | 3480 | 440 | West. | CS-324 |
| 1 | 10 | 1140 | 440 | Wagner | CP2-326 |
| 1 | 10** | 880 | 220 | West. | CS-365-EXPF |
| 1 | 15 | 1745 | 440 | West. | CS-326 |
| 1 | 15 | 1175 | 440 | L.A. | JA-365 |
| 1 | 20 | 1760 | 220 | G.E. | K-364 |
| 1 | 25 | 1760 | 220 | G.E. | K-365 |
| 1 | 25 | 1200 | 550 | G.E. | K-405 |
| 1 | 25 | 1170 | 220 | L.A. | JX-405 |
| 1 | 25 | 705 | 440 | West. | CS-W804 |
| 1 | 40 | 3565 | 440 | G.E. | KF-4058 |

**Splashproof, Ball Bearing**

| Qn. | H.P. | RPM | Volts | Make | Type |
|---|---|---|---|---|---|
| 23 | 5 | 1750 | 440 | L.A. | FX-254 |
| 1 | 5 | 1735 | 220 | G.E. | K-254 |
| 1 | 5 | 1160 | 440 | L.A. | FX-284 |
| 1 | 10 | 3480 | 440 | G.E. | K-284 |
| 1 | 15 | 1175 | 440 | L.A. | JA-365 |
| 4 | 15 | 1150 | 440 | L.A. | FX-365 |
| 2 | 40 | 1175 | 220 | G.E. | K-445 |
| 3 | 50 | 1760 | 440 | L.A. | FX-445A |
| 5 | 50 | 1160 | 220 | G.E. | K-504 |
| 1 | 125 | 1770 | 440 | L.A. | FX-1078Y |
| 1 | 150 | 1775 | 440 | L.A. | FX-1168 |
| 3 | 150 | 880 | 440 | L.A. | FX-1368 |
| 1 | 150 | 700 | 440 | G.E. | KF-6335 |
| 1 | 200 | 885 | 440 | L.A. | FB-1378 |

**Open Type Motors**

| Qn. | H.P. | Speed | Volts | Make | Type |
|---|---|---|---|---|---|
| 1 | 15 | 3485 | 220 | Reliance | A-83247 |
| 5 | 15** | 1735 | 440 | Century | SC326 |
| 1 | 15 | 1200 | 220 | G.E. | KT-502 |
| 1 | 15 | 900 | 220 | G.E. | FTR-512 |
| 1 | 20** | 3476 | 220 | West. | CS-326 |
| 5 | 20** | 1750 | 440 | Wagner | RPI-364 |
| 1 | 20 | 1750 | 220 | West. | CS-W364 |
| 1 | 20 | 1200 | 220 | G.E. | KF-512 |
| 2 | 20 | 1160 | 440 | West. | CS-464C |
| 2 | 20 | 900 | 220 | G.E. | FTR-522 |
| 1 | 25 | 1800 | 220 | G.E. | KT-312 |
| 5 | 25** | 1740 | 440 | Century | SC-364 |
| 1 | 25 | 1160 | 440 | West. | CS-667C |
| 1 | 25 | 900 | 220 | Howell | SCRB-356*** |
| 3 | 25** | 575 | 440 | Master | PB-405 |
| 2 | 25 | 575 | 440 | G.E. | KT-542 |
| 3 | 30 | 3550 | 550 | G.E. | K-3648 |
| 1 | 30 | 1160 | 440 | West. | CS-644 |
| 1 | 30 | 870 | 220 | West. | CS-646 |
| 1 | 40** | 3545 | 220 | G.E. | KF-4048 |
| 2 | 40 | 1750 | 440 | West. | CS-563C |
| 2 | 40 | 900 | 2300 | G.E. | FTR-536 |
| 4 | 50** | 1750 | 440 | Wagner | RP5-405 |
| 1 | 50 | 850 | 220 | West. | CCL |
| 2 | 60** | 1750 | 440 | Ideal | AH-444 |
| 2 | 60 | 900 | 440 | G.E. | KT-346 |
| 1 | 75 | 1160 | 440 | West. | CS-862C |
| 1 | 75 | 870 | 220 | West. | CS-766A |
| 2 | 75 | 885 | 2300 | G.E. | KT-353 |
| 1 | 100 | 690 | 220 | West. | C |
| 1 | 100 | 580 | 2200 | G.E. | IK-15A |
| 2 | 100 | 500 | 2200 | West. | CS-930 |
| 1 | 100 | 495 | 2200 | Al.-Ch. | AN |
| 2 | 125 | 435 | 440 | Al.-Ch. | AR |
| 2 | 125 | 600 | 2300 | G.E. | AT-FR |
| 1 | 200 | 580 | 550‡‡ | G.E. | KT-5668 |
| 1 | 500 | 1200 | 440 | G.E. | KTP-567 |
| 1 | 700 | 1800 | 2400/4000 | West | CS-4-3VD-12 |

220 volt motors can be reconnected for 440 volts.
**New ***2 Phase.
‡‡ Reconnectable for 440 volts

### G. E. DYNAMOMETERS

Cradle Type, with Control and Dial Scale
(Write for Complete Specifications)

| Qn. | HP | D.C. Volts | RPM | Type |
|---|---|---|---|---|
| 1 | 50/75 | 250 | 1650/4000 | TLC-20 |
| 2 | 100 | 250 | 1050/3600 | TLC-50 |
| 1 | 200 | 250 | 1200 | C |

### MOTOR GENERATOR SETS

**125 and 250 Volts D. C.**
(Write for complete Specifications)

| KW | Make | RPM D.C. | Volts A.C. | Volts |
|---|---|---|---|---|
| 2 | Cont. | 1750 | 125 | 220/440 |
| 7.5** | West. | 1455 | 125 | 380/220‡ |
| 10 | West. | 1750 | 125 | 220/440 |
| 10 | West. | 1450 | 125 | 220/440† |
| 10 | West. | 1150 | 250 | 220/440 |
| 15** | G.E. | 1800 | 125 | 220/440 |
| 15 | G.E. | 1735 | 250 | 220/440 |
| 15 | West. | 1450 | 125 | 220/440‡ |
| 16 | West. | 1750 | 125 | 2200/440 |
| 20 | West. | 1750 | 250 | 220/440 |
| 25 | G.E. | 1800 | 250 | 220/440 |
| 25 | G.E. | 1200 | 125 | 220/440 |
| 30 | G.E. | 1800 | 250 | 220/440 |
| 30 | Al-Ch | 1750 | 125 | 220/440 |
| 50 | West. | 1750 | 250 | 220/440 |
| 50 | G.E. | 720 | 125 | 220/440† |
| 75 | G.E.* | 1200 | 125 | 220/440 |
| 75 | G.E. | 1200 | 250 | 2300/440 |
| 100 | Columbia* | 1200 | 250 | 2300/440 |
| 150 | West.* | 1200 | 250 | 2300/4 0 |

Note: 3KW, 5KW and 7.5 KW, 250 Volt Sets Also Available.
**New *Synchronous Motor Driven.
‡50 Cycle †25 Cycle.

**Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.**

**ELECTRIC GENERATOR & MOTOR CO.**
4521 HAMILTON AVE. CLEVELAND 14, OHIO

THE HOME OF VALUE AND QUALITY FOR . . .

ELECTRICAL POWER EQUIPMENT

WE CARRY A COMPLETE STOCK OF . . .

# QUALITY GUARANTEED "REBUILTS"

Our facilities for rebuilding and repair work are of the finest in the nation and are supplemented by a staff of thoroughly experienced engineers.

*— Here's A Partial Listing —*
*If You Don't Find What You Need Here*
*Wire — Write or Phone*

## WE CAN SUPPLY IT!

**SQUIRREL CAGE MOTORS**
3 Phase, 60 Cycle 220 or 440 Volt (*2200 Volt or Higher)

| HP | Make | Type | Speed |
|---|---|---|---|
| 750 | *G.E. | KT | 720 |
| 700 | *G.E. | KF-56947 | 1800 |
| 600 | *Westg. | CS-6-34-15 | 1200 |
| 600 | *G.E. | K-559DZ | 3600 |
| 500 | *G.E. | IK | 1800 |
| 500 | G.E. | KTF-567 | 1200 |
| 500 | G.E. | IK | 900 |
| 400 | *G.E. | IK | 1800 |
| 400 | *Westg. | CS-936 | 1800 |
| 400 | Al. Ch. | ANW | 900 |
| 400 | *Westg. Vert | CS | 720 |
| 400 | G.E. | IK | 600 |
| 350 | *Westg. | CS | 900 |
| 350 | G.E. | IK | 600 |
| 350 | G.E. | IK-14 | 514 |
| 300 | G.E. | FT-559A | 1800 |
| 300 | G.E. | K-559DZ | 1200 |
| 300 | G.E. | IK | 900 |
| 250 | G.E. | KT-559 | 1800 |
| 250 | *Westg. | CS-875S | 1800 |
| 250 | *G.E. | IK | 900 |
| 250 | G.E. | KT-561 | 900 |
| 250 | Westg. | CS | 900 |
| 250 | *G.E. | IK | 600 |
| 200 | *Al. Ch. BB | AR | 1800 |
| 200 | Wagner | 36V | 1800 |
| 200 | Westg. BB | CS | 1800 |
| 200 | Bellance | AA-C60855 | 1200 |
| 200 | *Westg. | CS | 1200 |
| 200 | *Westg. | CS-956A | 900 |
| 200 | *G.E. | K | 720 |
| 200 | Westg. | CS-32B | 720 |
| 200 | Westg. | CS-950A | 600 |
| 200 | G.E. | IK-15A | 450 |
| 150 | Westg. | CS-771-1C | 1770 |
| 150 | *Westg. | CS | 1200 |
| 150 | Cont. TEFC | NP-743K | 900 |
| 150 | Westg. | CS-950A | 600 |
| 150 | *G.E. | KT-564 | 600 |
| 125 | Westg. BB | CS | 3600 |
| 125 | G.E. TEFC | K-6326S | 1200 |
| 125 | *G.E. | IK | 1200 |
| 125 | Al. Ch. BB | AR-826DS | 1200 |
| 125 | Al. Ch. New | AR-826F | 900 |
| 100 | *G.E. | KT | 1800 |
| 100 | Al. Ch. New | ARWW-822E | 1200 |
| 100 | Burke | EM-12.5 | 1200 |
| 100 | U.S. Vert. | CPU-994A | 1200 |
| 100 | Al. Ch. BB | ARZ-826 | 900 |
| 100 | G.E. | K-6333 | 720 |
| 75 | *Al. Ch. | AR-223-BS | 1800 |
| 75 | Al. Ch. BB | AR-505 | 1200 |
| 75 | Al. Ch. | AR | 1200 |
| 75 | G.E. TEFC | K-505 | 1200 |

**M.G. SET**

1000 K.W., Gen. Elec., type MH*, shunt, 275 volt, 3640 amp., direct connected to 1120 K.V.A. Gen. Elec. type TS, 3 ph, 60 cy, 4600 volt, 141 amp, .8 PF, 514 RPM, on fab. sub-base (250 volt fields bus excited)

**SLIP-RING MOTORS**
3 Phase, 60 Cycle—229 or 440 Volt (*2200 Volt or Higher)

| HP | Make | Type | Speed |
|---|---|---|---|
| 2500 | *G.E. | MT | 257 |
| 2000 | *G.E. | IM | 360 |
| 1600 | *Al. Ch. | ANY | 257 |
| 1200 | *G.E. | MT-26 | 277 |
| 1000 | *Westg. | CW-824 | 500 |
| 1000 | *Westg. | CW | 720 |
| 800 | *Westg. | CW | 507 |
| 700 | *Westg. | CW | 720 |
| 600 | *G.E. (5 brg) | ID | 300 |
| 600 | G.E. | IM | 360 |
| 600 | *Cr. Wh. | SB | 514 |
| 600 | *G.E. | IM | 900 |
| 500 | *Ideal | AV-500 | 1800 |
| 500 | *G.E. | IM | 720 |
| 500 | Al. Ch. | ANY | 600 |
| 500 | Westg. | HF | 400 |
| 500 | *Westg. | CW | 600 |
| 400 | *G.E. | MT-412 | 480 |
| 400 | *Al. Ch. | ANY | 514 |
| 400 | Westg. | CW | 900 |
| 400 | *G.E. | IM | 900 |
| 350 | Westg. | CW | 720 |
| 350 | Al. Ch. | ANY | 585 |
| 300 | G.E. | IM | 450 |
| 300 | *G.E. | IM-17B | 450 |
| 300 | *G.E. | IM | 600 |
| 300 | *Al. Ch. | ANY | 720 |
| 300 | G.E. | IM | 1200 |
| 300 | *G.E. | IM | 1800 |
| 250 | Westg. | CW-32-B | 900 |
| 250 | *Al. Ch. | ANY | 300 |
| 250 | *Al. Ch. | ANY | 450 |
| 250 | Westg. | CW | 600 |
| 250 | Al. Ch. BB | ARY-831A | 720 |
| 250 | Westg. | CW-32B | 900 |
| 200 | Al. Ch. BB | ARY-830D | 900 |
| 200 | Al. Ch. BB | ARY-826FS | 1200 |
| 200 | *G.E. | IM | 600 |
| 150 | G.E. | IM | 450 |
| 150 | Al. Ch. | ANY | 600 |
| 150 | *G.E. | IM | 720 |
| 150 | Al. Ch. NEW | ARY-826K | 900 |
| 125 | G.E. NEW | M-6334 | 720 |
| 125 | *G.E. | IM | 720 |
| 125 | G.E. NEW | M-6333 | 900 |
| 125 | *Al. Ch. BB | ARY-826 | 900 |
| 125 | Al. Ch. BB | ARY-826D | 1200 |
| 100 | G.E. | IM | 450 |
| 100 | Westg. | CW-550C | 575 |
| 100 | Al. Ch. | ANY | 720 |

**BALANCING SETS**

34 K.W., 250 volt, 270 amp. neutral Hogue, type MCL 125 volt generators BB, comp'd, d-c on fabricated base

20 K.W., 250 volt, 160 amp. neutral Cr.Wh., type 15L, 125 volt generators 3 sl. brg. Close coupled—solid coup.

## CHICAGO ELECTRIC

Has a modern up-to-date plant where all equipment is fully and skillfully rebuilt and houses a tremendous stock of . . .

- AC MOTORS
- DC MOTORS
- GENERATORS
- M.G. SETS
- CONVERTERS
- COMPRESSORS
- SWITCHBOARDS
- TRANSFORMERS
- CONTROLS
- HOISTS
- PUMPS

If you have an electrical power problem write us specifications and full information and we will be pleased to serve you.

WRITE YOUR NEEDS TODAY or PHONE

CANAL 6-2900

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## CHICAGO *Electric Co.*

1320 W. CERMAK ROAD • CHICAGO 8, ILLINOIS



AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK

# POWER PLANT EQUIPMENT

**STEAM ENGINE GENERATOR SETS**

2—575 KVA Skinner Unaflow—West. 240/480 V.
1—575 KVA Allis-Chalmers Corliss—220/440 V.
1—375 KVA Ames Vertical 220/440 V.
1—250 KVA Ridgeway four valve 2300 V.
1—187 KVA Ames Vertical 220/440 V.
1—156 KVA Ames Vertical 220/440 V.

**STEAM TURBINE UNITS**

Complete 2000 KW Turbo-Generator Plant:

1—1500 KW G.E. condensing—3600 RPM
1—500 KW G.E. condensing—3600 RPM

These units are of modern design, are 3 phase, 60 cycle, 2300 V.

**DIESEL GENERATING UNITS**

4 Diesel Generating Units, like new, comprising a complete diesel power plant, and consisting of two 450, one 300, and one 150 HP Fairbanks-Morse model 32-E engine-generator units. Engines are of all duplicate cylinder size, 2400/4160 V. 3 phase, 60 cycle. Lots model Woodward governors, pumps, cooling tower, etc. Operated only a short time. Available for immediate delivery.

1—250 KVA—220/440 V. G.M. "Twin"—NEW—not war surplus.

## BEESON ENGINEERING CO.

1628 E. 7th St., Los Angeles 21, Cal.
*MUtual 9151*



THOUSANDS OF ITEMS IN STOCK
*New & Reconditioned*

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CENTRIFUGAL
PLUNGER
ROTARY

Air Compressors—Steam Pumps
Vacuum Pumps—Turbo Blowers
Electric Motors & Generators
Gasoline & Diesel Engines
Gear Reducers & Transm. Supplies
Condensation Return Units
Steam Turbines & Engines
Hydraulic Pumps & Presses
Pressure & Exhaust Blowers
Paint Spraying Equipment
Portable Agitators & Mixing Tanks
*Above In All Sizes, Types, Makes*

## SUPERIOR EQUIPMENT CO.

136 GRAND ST., N.Y.C. 13. CA-6-6983



# TRANSFORMERS

**FOR SALE**

2— 150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6— 100 KVA. 60 CY. 1 PH. 2400-240/120.
6— 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

## ATLANTIC TRANSFORMER CO.

5143 N. 2nd St. Philadelphia 20, Pa.



**FOR SALE**

1—Norberg Uniflow Engine, 14x20, direct connected G.E. Generator, 125 KW, 240/3/60, with switchboard and voltage regulator. Excellent running condition.

1—Ames 12x12 Single Baker Valve Engine, direct connected G.E. 50 KW, 230/3/60 Generator, with switchboard.

1—100 HP, self-contained, Union Universal Boiler, 150# pressure.

**CHARLES V. FISH**

501 Commonwealth Bldg., Allentown, Penna.

# BREW-WOLTMAN OFFERS

### TURBINE UNITS

1—12500 KVA Al. Ch. Cond. 60 cy. 6900 V. 250-lb. 600 deg. Surface Condenser
1—12500 KVA Al. Ch. Cond. 60 cy. 13800 V. 240-lb.
1— 9375 KVA Cond. 50 cy. 13800 V. 600-lb. 825 deg. Surface condenser & boiler. NEW.
1— 5000 KVA G. E. Non-C. 60 cy. 13200 V. 600-lb.
2— 5000 KVA West. Cond. 60 cy. 13800 V. 240-lb.
2— 4500 KVA West. Cond. 60 cy. 6600 V. 200-lb.
1— 3125 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lbs., 40-lbs. BP
1— 1563 KVA G. E. Ext. 60 cy. 2300 V. 400-lb. IP, 160-lbs. Ext. Cond.
1— 1250 KVA DeLaval Non-C. 60 cy. 2300 V. 250-lbs.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lbs.
1— 940 KVA Elliott Cond. 60 cy. 480 V. 400-lbs.
1— 125 KVA West. Non-C. 60 cy. 240/480 V. 150-lbs., 5-lbs. BP.
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor.

### BOILERS

2—509 HP B. & W., 200-lb., 488 deg.
2—253 HP B. & W. 225-lb. Bent tube.
2—200 HP Erie Economic 125-lb. Stokers.
1—180 HP Frost 200-lb. Return tubular.

### DIESEL ENGINE UNITS

2—1600 HP Fair. Morse 60 cy. 2300 V. NEW gen.
2— 900 HP M.A.N. 2300 V. 60 cy. NEW.
1— 720 HP Amer. Loco. 240 V. DC
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 400 HP DeLaVergne 2400 V. 60 cy.
2— 240 HP Fair. Morse 2400 V. 60 cy.

### STEAM ENGINE UNITS

1—1125 KVA Nordberg Uniflow, 480 V.
1— 312 KVA Skinner Uniflow, 480 V.
1— 250 KVA Ames Vertical Uniflow, 480 V.
2— 187 KVA Ames Vertical Uniflow, 240 480 V.

## NEW MOTORS STOCK 20 — 200 HP

### SYNCHRONOUS MOTORS—60 CY.

2—3800 HP G. E. 2300 V. 257 RPM
1— 880 HP G. E. 6600 V. 514 RPM
1— 600 HP G.E. 440 V. 360 RPM
2— 500 HP E. M. 2200 V. 514 RPM
3— 400 HP E. M. 440 V. 600 RPM
1— 350 HP G. E. 440 V. 900 RPM
1— 300 HP G. E. 2300 V. 600 RPM
1— 300 HP West. 2300 V. 900 RPM
1— 200 HP G. E. 220 V. 600 RPM

### INDUCTION MOTORS—60 CY.

1—8000 HP Cr. Wh. S/R 2200 V. 895 RPM
2— 450 HP West. S/C 4150 V. 360 RPM
1— 300 HP West. S/R 2200 V. 1770 RPM
1— 250 HP G. E. S/R 2200 V. 1800 RPM
1— 200 HP Cr. Wh. S/C 2300 V. 900 RPM
1— 200 HP Cr. Wh. S/C 2300 V. 720 RPM. NEW.
1— 200 HP G. E. S/R 2200 V. 435 RPM
1— 150 HP Cr. Wh. S/C 440 V. 1800 RPM. NEW.
1— 150 HP Cr. Wh. S/C 440 V. 1200 RPM. NEW.
1— 150 HP Cr. Wh. S/C 440 V. 900 RPM. NEW.

### MOTOR GENERATOR SETS

2—1500 KW West. 250 V. DC 60 cy.
2—1000 KW G. E. 600 V. DC 60 cy.
1— 500 KW G. E. 250 V. DC 60 cy.
4— 94 KW G. E. 60 V. DC 60 cy.
1— 75 KW Star 240 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 18 KW West. 60 V. DC 60 cy.

### ROTARIES—60 CY.

1—2929/3705 KW Gen. Elec. 225/285 V.
1—2100/2700 KW Gen. Elec. 240/300 V.
2—2000 KW Gen. Elec. 600 V.
1—1000 KW Westinghouse 600 V.

### MERCURY ARC RECTIFIERS

2—4500 KW Multi Anode 600 V. DC
2—3250 KW Ignitron 650 V. DC
1—1850 KW Ignitron 275 V. DC

### FREQUENCY CHANGERS

1—12500 KVA G. E. 25/60 cy. 300 RPM
1— 1250 KVA West. 25/60 cy. 300 RPM
1— 2500 KVA G. E. 25/60 cy. 300 RPM
2— 1000 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

### TRANSFORMERS—60 CY.

4— 333 KVA West. 132000—7620/13200
1—2000 KVA G. E. 69000—13800/23900, 3 ph.
3— 500 KVA G. E. 66000—13200/6600
3—1000 KVA West. 66000—11000
1—5000 KVA West. 34500—13750 3 ph.
1—5000 KVA G. E. 33000—2300/4000, 3 ph.
1—3000 KVA West. 33000—2300/3990, 3 ph.
6— 50 KVA G. E. 33000—2300
6— 75 KVA Moloney 33000—2300/8000
3—3750 KVA West. 26400/13200—2400
4— 450 KVA Al. Ch. 25410/44000—13200/23000
3—1000 KVA Pittsburgh 22000/11000—2200.
1— 750 KVA G. E. 13200—480, 3 ph. Unit Sub.
2— 200 KVA G. E. 11500—220/110
3— 200 KVA Moloney 11000—2300
3— 167 KVA G. E. 2200/12400—240/480
1—1500 KVA West. 4000—2300, 3 ph. Auto.
3— 250 KVA Al. Ch. 2300—460
3— 500 KVA Pittsburgh 2300—230/460
3— 20 KVA West. 2200—575/287½
12— 15 KVA Standard 450/225—117/234
2—27½ KVA G. E. 440—220/110

### MOTOR GENERATOR SETS

2—1500 KW West. 250 V. DC 60 cy.
2—1000 KW G. E. 600 V. DC 60 cy.
1— 500 KW G. E. 250 V. DC 60 cy.
4— 94 KW G. E. 60 V. DC 60 cy.
1— 75 KW Star 240 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 18 KW West. 60 V. DC 60 cy.

### OIL CIRCUIT BREAKERS

| | | |
|---|---|---|
| 1— 400 A. 73 KV G. E. FHKO-236 | | Outdoor |
| 1— 400 A. 73 KV G. E. FHKO-136 | | Outdoor |
| 1— 800 A. 73 KV G. E. FHKO-139 | | Outdoor |
| 1— 400 A. 37 KV G. E. FHKO-136-CS | | Outdoor |
| 1— 400 A. 37 KV Condit FO-40-B | | Outdoor |
| 3— 400 A. 37 KV West. G-11 | | Outdoor |
| 1—1200 A. 25 KV G. E. FHKO-256 | | Outdoor |
| 4— 600 A. 15 KV G. E. FHKO-138BS | | Outdoor |

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## BREW. WOLTMAN & CO., INC.

50 Church Street — New York City 7, — WOrth 4-1470

### MOTOR GENERATORS

1—400 KW West. Syn. 600 V. DC, 720 RPM, 2300/4000 V. AC, 3 P., 60 C.

2—300 KW G.E. Syn. 250 V. DC, 1200 RPM 440/2300/4600 V. AC, 3 P., 60 C.

1—200 KW G.E. Syn. 250 V. DC, 1200 RPM 2300/4000 V. AC, 3 P., 60 C.

1—150 KW G.E. Syn. 250 V. DC, 1200 RPM 2300/4000 V. AC, 3 P., 60 C.

### SYNCH. CONVERTERS

1— 500 KW West. 250 V. 6 P., 60 C. 1200 RPM, 2300/4000/6900/13,200 V. Trans.

1—300 KW G.E. 250 V. 6 P., 60 C. 1200 RPM, 440/2300/4000/13,200 V. Trans.

1—300 KW G.E. 600 V. 6 P., 60 C. 1200 RPM, 2300/4000/6900/13,200 V. Trans.

### WALLACE E. KIRK COMPANY

502 Grant Building, Pittsburgh, Pa.

### asme—BOILERS—nat'l. b'd.

4—404 HP sectional header oil burners
1—400 | Erie City, low head (3) drum, oil.
2—500 | complete plant, 1942.
2—800 HP Stirling type low head spreader stokers complete plant 1942
3—84" suspended HRT single settings
Capacities based on 100% rating

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34-23—91st Street, Jackson Heights, N. Y.

# POWER PLANT EQUIPMENT

## *Special Offerings*

### TURBO-GENERATORS

2—New 4000 KW Cond. 2400/4160 V. 750° T.T.
1—3500 KW 2300 V Cond.
1—2500 KW 600 V Cond.
1—2500 KW 2300 V Cond.
1—2000 KW 600 V Cond.
1—1500 KW 480 V. Extract 400#
1—1500 KW 2300 V Cond.
2—1250 KW 2300 V Cond.
1—1000 KW 2300 V Non-C.
2—1000 KW 440 V Cond.
1—1000 KW 480 V. Extract 300#
1— 750 KW 480 V. Extract 145#
1— 750 KW 600 V Extr.
1— 600 KW 240 V Cond.
1— 400 KW 480 V Non-C.
1— 250 KW 2300 V Non-C.

### TURBO-GENERATORS (Continued)

1— 250 KW 240 V Non-C.
1— 150 KW 2300 V Non-C.
1— 125 KW 600 V Extrac.
1— 100 KW 600 V Non-C.
1— 50 KW 220 V Non-C.

### TURBINE—Only

1—New 465 HP—3550 RPM 900 PSI.

### WATER-WHEEL GENERATORS

2—250 KW Vert. 21' Hd. 3 ph. 60 cy—550 volts

### ENGINE GENERATORS

1—900 KW NEW Skinner Uniflow 2400/4160 volts
1—500 KW 2300 V Unif.
1—400 KW 125 V Unif.
1—375 KW 2300 V Unif.
1—188 KW 220 V Unif.
1—168 KW 550 V

### BOILERS

2—40,000# 200#
2—30,000# 425#
1— 623 HP 450#
1— 487 HP 200#
1— 300 HP 200#
1— 220 HP 160#
1— 200 HP 175#
6— 200 HP Sterling 160#
2— 190 HP 160# NEW

### AIR COMPRESSORS

1—6000 CFM 50# Motor
2—2000 CFM 100# Motor
1—1700 CFM 100# Motor
2—1299 CFM 100# Motor
1—6000 CFM 5.1# NEW
1—5000 CFM 10# Rotary Type Motor

***Write or wire for additional data and prints.***

**A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.**

**The Buyers Must Be Satisfied—Always**

# 750 KVA DIESEL ENGINE-A.C. GENERATOR SETS-COMPLETE

## SEVERAL FOR IMMEDIATE DELIVERY

**A FEW OTHER DIESEL POWER UNITS IN OUR STOCK:**

—Hamiltons, 1600-HP., 720-RPM., with West. Reversing Reduction Gears: SAME AS NEW: 15—Baldwin-Westinghouse 300-KW. DC., 240-v., 400 RPM.: 4—GM. Model 3-268-A, 100-KW. 4—FM. O.P. 1200-HP., 720-RPM., Engines, 8-cyl. Nearly New. AND MANY OTHERS. Write Us, Stating Your Requirements.

*Our stock is large and includes almost anything wanted in Diesel Power*

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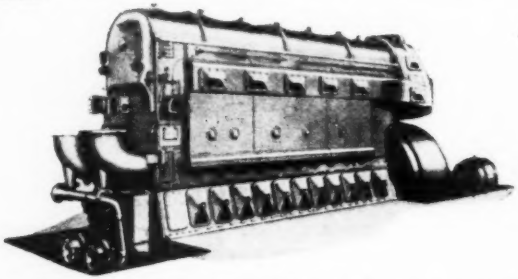

*Always get Charles Weaver's prices before buying*

*They will save you THOUSANDS OF DOLLARS*

*Same on Turbine-Generators and Boilers*

Cut shows Fairbanks-Morse 1600-HP., Opposed Piston Engine, direct connected to a NEW 1250-KVA., 3/60/2300/4160-v. AC. Generator.

These machines are specially adapted for ALL Stationary and Marine Installations. Many Municipals are now operating them.

TURBO-GENERATORS: We Carry one of the largest stocks in the USA.

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Good Equipment
Immediate Deliveries
Right Prices

# MOTORS • GENERATORS • TRANSFORMERS

### MOTORS
### 3 PHASE—25 CYCLE—220/440 VOLTS

| H.P. | Make | Type | Frame | RPM |
|---|---|---|---|---|
| 150 | Gen. Elect. | IK-17 | | 365 |
| 150 | Gen. Elect. | IK-16 | | 480 |
| 150 | Gen. Elect. | IM-16 | Slip Ring | 480 |
| 150 | Allis Chalmers | | | 1450 |
| 150 | Gen. Elect. | KT | 557 | 1455 |
| 200 | Westinghouse | CS | 2200 volt | 1500 |
| 250 | Westinghouse | CW | Slip Ring | 500 |
| 500 | Gen. Elect. | IK | | 485 |
| 600 | Gen. Elect. | MT | Slip Ring | 490 |
| 600 | Westinghouse | CS | | 490 |

### INDUCTION HEATING SET

**GENERATOR**—175 KVA General Electric A.C. Generator, type A.S.C. form AL, single phase, 800 volts, 3000 cycle, 1800 RPM, serial #5513629.

**GENERATOR EXCITER**—1 KW, General Electric Generator, type EE, form EB, 125 volts, D.C., 1800 RPM, 8 amps., serial #1758709.

**MOTOR**—300 HP General Electric synchronous motor, type TS, form EL, 8 P.F., 3 phase, 60 cycle, 440 volts, 1800 RPM, serial #5513638.

**MOTOR EXCITER**—3 KW, General Electric Generator, type EF, form EB, 125 volts, DC, 1800 RPM, 24 amps, serial #1758730.

Motor and Generator are direct connected, 4 bearing. Mounted on factory fabricated base, with direct connected exciters.

3000 Cycle Control is mounted in cubicle also containing 300 HP Gen. Elec. synchronous motor starting control.

### 6250 KVA TURBO-GENERATOR

1—6250 KVA Gen. Elect. Unit—Generator 3 Phase, 60 cycle 2300/4160 Volts 3600 RPM. Complete Installation For Immediate Delivery.

### 200 HP SYNCHRONOUS MOTOR

200 HP Gen. Elect. Synch. Motor—New 3/60/2300 225 RPM. 1.0 PF Engine type with M-G set for excitation and 200 HP Gen. Elec. New Full Voltage Syn. Dead Front Control Panel.

### 700 KW M.G. SET

1—350 KW Gen. Elect. Type MPC 250 volt, 720 RPM Generators will direct connect to 1000 HP Synchronous Motor or will sell Generators separately.

### 200 KW M.G. SET

200 KW Westinghouse NEMA Frame Generator 250 Volt DC, 1200 RPM, direct connected to 300 HP Westinghouse Synchronous motor 3/60/208/1200 RPM. A.C.—D.C. Panels—Like New.

Immediate Shipment.

### SLIP RING MOTORS
### 3 Phase—60 Cycle—220/440 Volts

| H.P. | Make | Type-Frame | Speed | Remarks |
|---|---|---|---|---|
| 2— 20 | LA1 | KH | 900 | |
| 20 | G.E. | MT-303 | 1800 | |
| 30 | Cr. Wh. | | 1800 | |
| 3— 35 | West. | CW | 585 | |
| 35 | G.E. | MT-342 | 690 | |
| 35 | West. | MW | 680 | |
| 40 | West. | CW-748A | 690 | |
| 6— 40 | G.E. | MT-358 | 1200 | |
| 40 | G.E. | MT-523 | 1800 | |
| 50 | G.E. | MT-536 | 1200 | |
| 50 | G.E. | MT-527 | 1800 | |
| 2— 50 | West. | CW | 1800 | |
| 60 | G.E. | MT-533 | 1800 | |
| 60 | West. | CW-653C | 1800 | |
| 100 | West. | CW | 435 | 3 bearing |
| 2—100 | G.E. | I form M | 900 | |
| 2—100 | G.E. | MT-347 | 1800 | |
| 125 | G.E. | I form M | 1200 | |
| 2—250 | G.E. | I form M-16 | 900 | |
| 350 | West. | CW | 435 | 2200 volts |
| 500 | Al. Ch. | ANY-WR | 514 | 2200 volts |
| 600 | G.E. | MT | 450 | 25 cycle |

This motor will rewind satisfactorily to 700 G.E. MT 720

### HORIZONTAL & DUPLEX
**Compressor & Vacuum Pumps after Coolers, Filters**

### NEW TRANSFORMERS
**Stock Shipment**

3—25 KVA Niagara O.I.S.C. 2400/120/240, 1 Phase, 60 cycle, with taps.
6—25 KVA Niagara O.I.S.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
3—37½ KVA Niagara O.I.S.C. 2400/120/240, 1 Phase, 60 cycle, with taps.
6—37½ KVA Niagara O.I.S.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
3—50 KVA Niagara O.I.S.C. 2400/120/240, 1 Phase, 60 cycle, with taps.
4—50 KVA Niagara O.I.S.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
3—75 KVA Niagara O.I.S.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
3—100 KVA Niagara O.I.S.C. 2400/120/240, 1 Phase, 60 cycle, with taps.
7—100 KVA Niagara O.I.S.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
8—150 KVA Niagara O.I.S.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
3—167 KVA Niagara O.I.S.C. 2400/100/240, 1 Phase, 60 cycle, with taps.
3—250 KVA Niagara O.I.S.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
3—333 KVA Niagara O.I.S.C. 2400/240/480, 1 Phase, 60 cycle, with taps.

### TRANSFORMERS

3—100 KVA Gen. Elect. Transformers, Type H Form KF—2400/4160 volts primary 120/240 volts secondary. Price $450.00 each. Electrically O.K. F.O.B. truck, Minnesota.
2—70 KVA Gen. Elec. Transformers, Type H Form K—1 Phase 60 Cycle 2300 Volts Primary 115/230 Serial No. 3154838.
1—200 KVA Westinghouse Transformers, Type SK—1 Phase 25 Cycle 2300 Volts Primary 115/230 Volt Secondary, Serial No. 1214689-90-91.

### PLATING GENERATOR

3000 Amp. Hansen Van Winkle 6—12 volt, 400 RPM

### FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle.

## ERIE ELECTRIC CO., INC.
124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

# MOTORS - M.G. SETS - CONTROLS

## AT REDUCED PRICES!

### M-G SETS

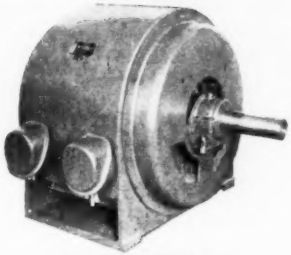
**G.E. 600 KW M-G SET**
250 volts D.C., 900 RPM, 875 HP, TS, 80% P.F. Syn. Motor. Complete with control. Can furnish for any A.C. voltage.

| KW | D.C. Volts | A.C. Volts | Mfg. |
|---|---|---|---|
| 500 | 250 | 2200 | C-W |
| 400 | 125/250 | 2300 | Ideal |
| 300 | 250 | 2200 | G.E. |
| 300 | 125/250 | 2300 | Allis |
| 200 | 250 | 2200 | Whse. |
| 200 | 125/250 | 2200 | G.E. |
| 150 | 250 | 440 | G.E. |
| 125 | 250 | 440 | Whse. |
| 100 | 250 | 440 | G.E. |
| 75 | 250 | 440 | C-W |
| 60 | 250 | 220 | G.E. |
| 50 | 250 | 440 | Whse. |

### SYNCHRONOUS

| HP | RPM | Volts | Mfg. | Type |
|---|---|---|---|---|
| 800 | 150 | 440 | G.E. | 80% |
| 650 | 138 | 2200 | Whse. | Engine |
| 600 | 450 | 2200 | G.E. | 80% |
| 500 | 514 | 440 | E-M | 100% |
| 500 | 600 | 2200 | E-M | 100% |
| 400 | 900 | 2300 | Whse. | 80% |
| 400 | 720 | 440 | G.E. | 80% |
| 400 | 600 | 440 | G.E. | 100% |

### SLIP RING



*New—220/440 v.*

| HP | RPM | Mfg. | Shaft |
|---|---|---|---|
| 500 | 1200 | Elliott | 4½ x 8" |
| 125 | 720 | Elliott | 4 x 12" |
| 100 | 720 | Elliott | 4 x 12" |

*Reconditioned and guaranteed*

| HP | RPM | Volts | Mfg. |
|---|---|---|---|
| 700 | 720 | 2300 | Allis |
| 500 | 450 | 2300 | G.E. |
| 450 | 514 | 440 | Whse. |
| 350 | 900 | 2300 | Whse. |
| 350 | 450 | 2300 | Whse. |
| 250 | 900 | 440 | Whse. |
| 200 | 1200 | 440 | G.E. |
| 150 | 900 | 2300 | C-W |
| 125 | 900 | 440 | Whse. |
| 125 | 720 | 440 | E-M |
| 100 | 600 | 2200 | A-C |

### NEW DIRECT CURRENT

**230 VOLTS**
**Drip proof — ball bearing**

| Qu | HP | RPM | Mfg. | Frame |
|---|---|---|---|---|
| 5 | 250 | 1750 | A-C | 149 |
| 2 | 75 | 1750 | F-M | 1509 |
| 1 | 75 | 400/1200 | Rel. | 651-T |
| 5 | 30 | 850/1700 | Rel. | 230 T |
| 1 | 10 | 575/2300 | L-A | 4051 |
| 3 | 10 | 1750 | Rel. | 34-T |
| 5 | 7½ | 575/2300 | G.E. | 77-CD |
| 15 | 5 | 850/1700 | G.E. | 66-CD |
| 3 | 3 | 690/2660 | G.E. | 284 |

*Reconditioned and guaranteed*

**230 VOLTS D.C.**

| HP | RPM | Mfg. | Brg. |
|---|---|---|---|
| 250 | 400/1200 | E-D | Ball |
| 200 | 300/900 | Whse. | Ped. |
| 200 | 400/1200 | Rel. | Ball |
| 150 | 350/1200 | Whse. | Ped. |
| 150 | 300/1050 | C-W | Ball |
| 125 | 400/1200 | G.E. | Slv. |
| 125 | 300/900 | Rel. | Slv. |
| 100 | 600/1500 | Rel. | Ball |
| 100 | 500/1500 | C-W | Ball |
| 100 | 475/1350 | E-D | Slv. |
| 75 | 500/1500 | C-W | Ball |
| 60 | 400/1200 | Whse. | Slv. |
| 50 | 350/1050 | Whse. | Ball |
| 40 | 600/2400 | Allis | Ball |
| 40 | 400/1600 | Rel. | Ball |
| 35 | 400/1200 | Ideal | Slv. |
| 20 | 400/1600 | G.E. | Slv. |
| 15 | 575/2300 | L-A | Ball |
| 15 | 400/1600 | Whse. | Slv. |

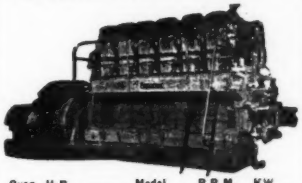
***Buy from BOSWICK with confidence***

WAlbridge 1195

# BOSWICK ELECTRIC CO.

P.O. BOX 55 — AKRON 9, OHIO

## ENTERPRISE DIESELS



| Quan. | H.P. | Model | R.P.M. | KW | |
|---|---|---|---|---|---|
| *2 | 450 | Enterprise DSG-6 | 450 | 300 | AC |
| *2 | 450 | Enterprise DSG-6 | 450 | 300 | DC |
| 2 | 1800 | General Motors 16-278A | 720 | 1000 | AC |
| *2 | 240 | Buskeye Model 80 | 900 | 160 | AC |
| 2 | 150 | General Motors 3-298A | 1200 | 100 | DC |
| 2 | 150 | General Motors 3-298A | 1200 | 100 | AC |
| *2 | 90 | General Motors 6-71 | 1200 | 60 | AC |
| *2 | 90 | General Motors 6-71 | 1200 | 60 | DC |

* New

**Diesel Motors**
PORT WASHINGTON, L. I., N. Y. CORPORATION TEL. PORT WASHINGTON 3000

## DIESEL GENERATOR PLANTS

### COMPLETE WITH SWITCHBOARDS

1000 KW to 100 KW
STATIONARY and PORTABLE
AT GREATLY REDUCED PRICES
NEW UNIT GUARANTEE

**HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.**

Tel. NEvada 6-2808
Cable Address HEMCOY

1412 So. Alameda Street
Compton, Calif.

## FOR SALE

5-10-15-75 Ton O.E.T. Cranes
250 HP Ideal Sq. Cage Motor—1200 RPM
150-150-175-200 HP Slip Rg. Motors
450 HP B&W Sectional Header, Boiler
400 & 342 KVA Gens. Dir. Con. Engines
2000 Ft. Air Compressor with Sya. Motor
1825-1250-900 HP Diesel Electric Sets
100,000 Gallon Water Tower & Tank
H. & P., 6719 Etzel Ave., St. Louis 14, Mo.

## SPECIAL TRANSFORMERS — YOUR SPECIFICATIONS

NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGERS

**ARROW TRANSFORMER CO., INC.**
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0488

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

## POWER EQUIPMENT

NOW! REDUCED PRICES ON ALL BOILERS

# NORTHERN METAL CO.

IMMEDIATE DELIVERY

## -BOILERS-

Scotch Cylindrical Return Tube
Built by Union Iron Works Co.
2 Furnaces, coal fired
T.S. 60,000 lb.

Cleaver Brooks
Fire Tube Marine Package Type
60 H.P.
100 lb. Max. Working Pressure
2,000 lb. Steam per hr. at 35 lb. pressure.

Yarrow 3 Drum Bent Tube
Max. Steam per hr. 65,000 lb.
Normal 55,000 lb.
Working Pressure 225 P.S.I.
Test Pressure 387 P.S.I.
Heating Surface 6256 Sq. Ft.

NUMEROUS OTHER ITEMS ARE AVAILABLE FOR INDUSTRIAL USE

Wickes Water Tube, 3 Drum
55,000 lb. Steam per hr. normal
65,000 lb. Steam per hr. max.
628 H.P.
Working Pressure, 250 lb.

Babcock & Wilcox Water Tube Boilers
22,500 lb. Steam per hr.
Working Pressure 250 P.S.I.
Heating Surface 4874 Sq. Ft.

**MILNOR & BLEIGH STS.** • ***Phone MAyfair 4-1400*** • **PHILA. 35, PA.**

## B & W COAL PULVERIZER

***AVAILABLE FOR IMMEDIATE SHIPMENT***

This is an unused size 32, class 221-BA Babcock & Wilcox coal pulverizer. Capacity is 7500 pounds of coal per hour based on a grind ability of 57 Hargrove scale, large enough for 80,000 pounds per hour boiler. With pulverizer is furnished a pulverizer feeder, pulverizer fan, an AC motor, 125 HP, 1800 RPM, 3 phase, 60 cycle, 2300 volts to drive pulverizer and fan, and a ¾ HP multispeed motor to drive feeder. Also included is a Bailey meter with differential pressure type control.

The unit is complete with tools and accessories, is 3 years old, but has never been used. Asking $12,000 F.O.B. Lansdale—will listen to reasonable offer. We will load pulverizer on cars. Address inquiry to:

**CHARLES M. ANDERSON, *Superintendent***
**LANSDALE MUNICIPAL POWER PLANT, LANSDALE, PA.**

## IMMEDIATELY AVAILABLE

New—Unused—Unerected—Complete
Babcock & Wilcox Water Tube Boilers

1—600 P.S.I. 740° F. Superheat 150,000 lb. per hour maximum 110,000 lb. per hour normal complete with oil burners.

1—600 P.S.I. 740° F. Superheat 115,000 lb. per hour maximum 85,000 lb. per hour normal complete with oil burners.

*Also specialize in*
Diesel Generators—Turbo—Generators
*Write—Wire—Phone*

**DEAN G. STRICKLER & ASSOCIATES**
1346 Conn. Ave., N.W., Washington, D. C.
Dupont 3386

## MARVELOUS VALUE

506 HP BROS Watertube Boiler with Waterwalls & Bros Spreader Stoker. Capacity 43,000# steam; 290# w.p., Performance Like New. Has Saved $20,000.00 per year on Fuel. Very Low Price for Quick Sale.

Wire
**ALLIED EQUIPMENT CO.**
Louisville, Ky. HI-2138

## COMPLETE POWER PLANTS

**STEAM — ELECTRIC — HYDRO — DIESEL**
***"Export Orders Carefully Executed"***

| BOILER UNITS | TURBO UNITS |
|---|---|
| 1—140,000# New Steam Generator 600#, also Super | 1—20,000 KW Turbo-Generator—Cond. |
| 2—80,000# Boilers, 825#, 825° F.tt., Economizer and Air-heater | 1—10,000 KW Turbo-Generator—Cond. |
| 2—80,000# MODERN Boilers 450# | 1— 7,500 KW Turbo-Generator—Cond. |
| 2—30,000 MODERN Steam Generators 450# | 1— 5,000 KW Turbo-Generator—Cond. |
| 3—1000 HP Vogt 300# with Super | 2— 2,500 KW same as above |
| 2—1040 HP Heine Boilers—Super 200# | 3— 2,000 KW same as above } Also 400 & |
| 3— 750 HP Stirling Type Boilers 200# | 2— 1,500 KW same as above } 600# Turbos |
| 1— 400 HP B&W Co. Sectional—Super 200 to 450# | 3— 1,250 KW same as above |
| 4— 300 HP B&W Sectional Header 250# Boilers. | 2— 1,000 KW same as above |
| 2— 500 HP Straight Tube 200# Boilers | 1—500 KW same—Also 750 KW & 300 KW Units |
| Also smaller Boilers & Fire Tube Boilers | Non-Cond.:—300 - 500 - 750 - 1000 - 1500 - 2000 |

COMPLETE STEAM PLANTS: One with 2-1500 KVA's, One of 2500 KVA & One of 7500 KVA.
Frequency Changers—Transformers! Send us your requirements—We may have it.
Send us your INQUIRIES for ALL POWER MACHINERY
**CHARLES B. REARICK** **30 CHURCH ST.** **NEW YORK 7, N. Y.**

## FOR SALE

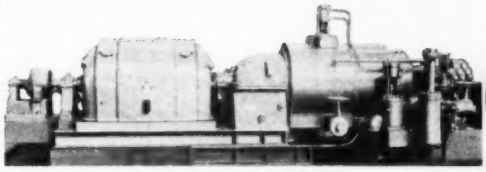
BRAND NEW—"LUBE OIL COOLERS"—Steel Shell; Bronze Heads; Copper Nickel Tube Sheets and Tubes

10—"PATTERSON-KELLEY" Single Pass 344 Sq. Ft. Heat Transfer Surface. Price:—$500.00 each

*Full details furnished upon request.*

J. A. DOUGHERTY—
P. O. Box 90,
BALA-CYNWYD, PA. M-5

# POWER PLANT MACHINERY

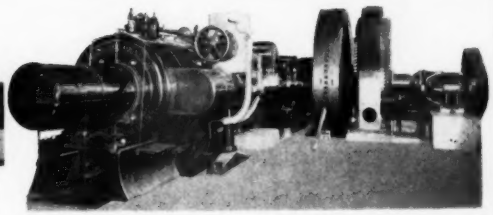


2500 KVA ALLIS CHALMERS CONDENSING TURBO UNIT

2000 KW 80% P.F. 2500 KVA Allis Chalmers Generator, 3 phase 60 cycle 4160/2300/600/480 volts, direct connected to 2000 KW Allis Chalmers condensing turbine, 400# steam pressure, 650° TT, 3600 RPM.

Equipped with direct connected exciter, surface condenser and auxiliaries.

*New 1933—Excellent Condition—Can be shown in operation*



750 KVA SKINNER NON-CONDENSING UNIFLOW UNIT

750 KVA Westinghouse generator, 3 phase 60 cycle 2300/600/480/240 volts, direct connected to Skinner Universal Uniflow non-condensing engine, 150# steam pressure, 5# back pressure, 150 RPM.

Equipped with belt driven exciter, and rheostats.

*New 1930—Excellent Condition*

***Wire or phone for further details and prices.***

**INTERNATIONAL POWER MACHINERY CO.**

**UNION COMMERCE BLDG.** **Telephone: MAin 9514** **CLEVELAND 14, OHIO**

# Modern Equipment

## DIESEL ENGINES

| HP | MAKE | MODEL | RPM | CYCLE | YEAR |
|---|---|---|---|---|---|
| 1800 | General Motors | 16-258S | 900 | 4 | 1943 |
| 1600 | Fairbanks Morse | 38D8½OP | 720 | 2 | 1944 |
| 1600 | Hamilton | RB99-D.A. | 700 | 2 | 1944 |
| 1600 | General Motors | 16-278A | 720 | 2 | 1944 |
| 1200 | General Motors | 12-278A | 750 | 2 | 1944 |
| 1200 | General Motors | 16-184A | 1800 | 2 | 1945 |
| 900 | General Motors | 12-567ATL | 750 | 2 | 1942/44 |
| 900 | General Motors | 6051 Quads | 650 | 2 | 1943 |
| 500 | Superior | 6-cyl. | 514 | 4 | 1942 |
| 300 | Fairbanks Morse | 38-O/P | 1200 | 2 | 1936 |
| 225 | General Motors | 6-71 | 2100 | 2 | 1943 |
| 150 | Superior | GDB-8 | 1200 | 4 | 1942/44 |
| 90 | Hercules | DWXDS | 1800 | 4 | 1943 |

## DIESEL GENERATOR SETS

| | | | | | | |
|---|---|---|---|---|---|---|
| AC | 200 KW | 3/60/450 | 1200 RPM | General Motors | 8-268A | 1943 Rebuilt |
| | 100 KW | 3/60/450 | 1200 RPM | General Motors | 3-268A | 1943 Rebuilt |
| DC | 1200 KW | 525 V | 750 RPM | General Motors | 16-278A | 1943 |
| | 650 KW | 240V | 750 RPM | General Motors | 12-567 | 1943 |
| | 290 KW | 120/240 | 1200 RPM | General Motors | 8-268A | 1944 |
| | 125 KW | 120/240 | 600 RPM | Superior | VDMB | 1944 |
| | 100 KW | 120/240 | 1200 RPM | Superior | GDB-8 | 1942/44 |
| | 100 KW | 120/240 | 1200 RPM | General Motors | 3-268A | 1943/44 |
| | 60 KW | 120V | 1200 RPM | Buda | 909 | 1942 |
| | 10 KW | 120V | 1200 RPM | Hercules | DOOD | 1943 |

## MOTORS—D.C.

| | | | | |
|---|---|---|---|---|
| 1500 HP | 525 V DC | 600 RPM | Whse. | |
| 667 HP | 374 V DC | 1300 RPM | Elliott. | |
| 444 HP | 250 V DC | 900 RPM | Elliott. | |
| 222 HP | 230 V DC | 3050 RPM | Whse. | |
| 15 HP | 120 V DC | 500 RPM | Diehl | |

***Ask for our***
**CATALOG**

## TURBO-GENERATORS—A.C.

1—1000 KW All. Chalmers 3/60/600, 3600 RPM, cond., 140# steam press.
2—250 KW G.E. type AT1 3/60/450, 1200 RPM, cond.
2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).
6—200 KW G.E. type ATB 3/60/450, 1200 RPM cond. and non cond.
2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

## TURBO-GENERATORS—D.C.

| KW | Volts | Winding | Speed | Type |
|---|---|---|---|---|
| 2—375 | 180/240 | Shunt. | 1200 | non-cond. |
| 5—300 | 120 | Compd. | 1200 | cond. |
| 1—300 | 240 | Compd. | 1200 | cond. |
| 4—150 | 120 | Shunt. | 1200 | cond. |
| 8— 60 | 120 | Stab. Sh. | 1800 | cond. |
| 3— 25 | 120 | Stab. Sh. | 1800 | cond. |

## MOTOR STARTERS

150—New Magnetic push button Line Starters, AC, rated 7½ HP at 440V, 5 HP at 220V, 3 HP at 110V, Westinghouse and Ward Leonard. Also DC.

8—Magnetic Starters for 50 HP, 3/60/440 motors, Cutler Hammer.

**WRITE OR CALL FOR DETAILS**

**HUGO NEU CORPORATION**
**31 Nassau Street** **New York 5, N. Y.**
***Tel. REctor 2-1334***

**ARRANGE FOR INSPECTION**

*Quality* SINCE 1906 **Wente Motors**

WIDE SELECTION UNUSUAL VALUES

## THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT . . . BY EXPERTS

**SQUIRREL CAGE**
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 50 | G.E. | I (2200 V.) | 900 |
| 2 | 50 | Al. Ch. | | 900 |
| 1 | 60 | G.E. | KT | 1800 |
| 4 | 60 | G.E. | KT (2200 V.) | 1200 |
| 1 | 60 | Reliance | AA | 900 |
| 1 | 75 | G.E. | KT | 1250 |
| 1 | 100 | G.E. | KT (2200 V.) | 900 |
| 4 | 100 | G.E. | K (TEFC'BB) | 1200 |
| 1 | 110 | G.W. | KTP | 1800 |
| 1 | 120 | G.E. | FT | 3600 |
| 2 | 125 | Cr. Wh. | 126Q | 450 |
| 8 | 135 | Al. Ch. | AR | 450 |
| 2 | 150 | Al. Ch. | | 1750 |
| 1 | 200 | G.E. | I-17 | 900 |
| 1 | 250 | G.E. | KF (Vert.) | 3600 |

**SLIP RING—SYNCHRONOUS**
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

| | | | |
|---|---|---|---|
| 1 | 50 | Al. Ch. | 720 |
| 1 | 50 | Ideal | 600 |
| 1 | 50 | G.E. | 700 |
| 1 | 60 | Ideal | AVX 1200 |
| 1 | 75 | West. | CW 400 |
| 1 | 75 | G.E. | 720 |
| 1 | 75 | Fair. Morse | BV (2200 V.) 1800 |
| 1 | 100 | G.E. | TRB (1.0 PF) 600 |
| 1 | 100 | G.E. | I-16 (2200 V.) 450 |
| 1 | 100 | West. | CW (8 P.) 1800 |
| 1 | 100 | A-W G.E. | AT3 (.8 PF) 900 |

| Qu. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 125 | Fair. Morse | T (2400V)(PF1.0) | 900 |
| 1 | 150 | G.E. | TM (.8 PF) | 1800 |
| 1 | 150 | West. | CW | 450 |
| 1 | 200 | G.E. | TRC (.8 PF) | 400 |

**D.C.—230 Volt**
(Other voltage as noted)

| | | | | |
|---|---|---|---|---|
| 1 | 50 | West. | SK | 850 |
| 1 | 50 | G.E. | CD 1341 | 800/2000 |
| 3 | 50 | Reliance | T | 2700 |
| 1 | 50 | West. | SK (115 V.) | 500 |
| 1 | 60 | West. | SK (115 V.) | 800/1600 |
| 1 | 75 | Diehl | K11 | 700 |
| 1 | 100 | West. | SK | 850 |
| 1 | 100 | Cr. Wh. | CM | 600 |
| 1 | 130 | Cr. Wh. | CMC (550 V.) | 1200 |
| 1 | 150 | West. | SK | 850 |
| 1 | 180 | Cr. Wh. | CMC | 850 |
| 2 | 200 | G.E. | TLC-74 | 1350/4000 |

**M-G SETS**

1— 45 KW West. 60 V DC—440 V AC 1200 RPM
4— 60 KW G.E. 60 V DC—440 V AC 1200 RPM
2— 75 KW El. Prod. 220 V DC—440 V AC
1200 RPM
1—100 KW Reliance 250 V DC—220 V AC
1200 RPM
1—100 KW Ridge 250/275 V DC—440 V AC
1200 RPM
1—105 KW Century 70 V DC—440 V AC
1200 RPM
1—150 KW G.E. 250/275 V DC—440 V AC
900 RPM

ALSO—4000 motors other than listed from 1 HP to 800 HP

**The Wente Electric Co.,**
Hamilton 203 NO. FOURTH ST. Ohio
Phone 4-8128

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**Vertical Hydro-electric Units**

2—500 KVA 3 ph. 60 cy. 2300 v. 225 RPM for 20-24' head
2—270 KVA 3 ph. 60 cy. 2300 v. 225 RPM for 9-13½' head
1—225 KW 3 ph. 60 cy. 2300 v. 180 RPM for 18-22' head
1—168 KW 3 ph. 60 cy. 2300 v. 150 RPM for 10-15' head
1—144 KW 3 ph. 60 cy. 550 v. 120 RPM for 9-13' head
1— 80 KW 3 ph. 60 cy. 2300 v. 300 RPM for 12-22' head.

Several horizontal units in good condition priced to sell. All subject to prior sale. We are headquarters for good hydroelectric units. For full particulars write

WM. C. MOULTON ASSOCIATES
MONSON, MASS.

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**NEW CHRYSLER DIESEL POWER UNITS**

75 HP Model IND-3, 6 Cyl., Elec. Start. Includes Radiator, 4 Batteries, Spare Parts & Twin Disc Clutch.

75 KW Caterpillar Diesel Generating set. 6 Cyl., 4 Cy., 900 RPM, direct conn. to: 92.5 KVA AC Generator, 3 60 127/220 volts. Mounted on steel base with radiator. Rebuilt.

*Other sizes in stock from 10 to 1000 KW.*

**ALJOHN DIESEL CO., INC.**
**904-10 Pacific St., Brooklyn 16, N. Y.**
**STerling 3-6515**

---

**BOILER FEED PUMP**

600 GPM, 2310 ft. hd., 6 stage, Worthington, Type 4-UX-2, connected to 500 HP Allis-Chalmers Motor, 440/3/60, Control.

*New—Never Used.*

**DELL STEPHENSON & CO.**
2565 GUARDIAN BLDG., DETROIT 26, MICH.

---

1—Fairbanks-Morse and Co., 6 cylinder, Model 32-E-14, 45 HP, 300 RPM, Diesel engine, S/N 876106. Equipment direct connected to 300 KW, Type TGZP, Frame VI, 375 KVA, 80% P.F., 240 volt, 3 phase, 60 cycle, 300 RPM, 903 Amps, Fairbanks-Morse alternator. Fairbanks-Morse V belt driven exciter, Type DG, Frame LA-326, S/N X70134, 10 KW, 125 volts. With panel board on which are mounted:

1 G.E. air circuit breaker. Type AL2-50, 600 volt, 60 cycle, 1000 Amp, 3 poles, 1 Burlington regulator, size GB4B, G.E. 0-300 scale volt meter, G.E. 0-1500 scale ammeter.

**PORTER**
**ELECTRIC COMPANY, Inc.**
**116 THIRD AVENUE, NORTH**
**MINNEAPOLIS 1, MINNESOTA**
**LINCOLN 7531**
*Electrical Equipment Coast to Coast*

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**DIESEL POWERED PUMPING EQUIPMENT**

A NUMBER OF 2 CYCLE & 4 CYCLE DIESEL ENGINES 200 TO 750 HP. ALL UNDER 300 R.P.M. GEARED TO PLUNGER PUMPS HANDLING 420 TO 1470 GPM AT 750 LBS. ON FOUNDATIONS IN ILL., MO., KAN., AND OKLA. WILL SELL UNITS COMPLETE OR ENGINES AND PUMPS SEPARATELY.

PRICED TO ALLOW PURCHASE OF ENGINES OR PUMPS FOR SPARE PARTS

*INQUIRE—PURCHASING AGENT*

**STANOLIND PIPE LINE CO.**
Box 1979, Tulsa, Oklahoma

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**COMPRESSORS**
**VACUUM PUMPS**
**NEW AND GUARANTEED REBUILTS**
**SAVE 40% TO 60%**

**SPECIALS**
TWO STAGE RADIAL
284 CFM INGERSOLL Type 40 W/Base, Drive & Motor
140 CFM to 270 CFM SULLIVAN "WL-60" 25 to 50 HP.
142 CFM to 285 CFM GARDNER "WB" 25 to 50 HP.
3000#—110 CFM INGERSOLL 4 Stage—Like New
MANY OTHER MAKES AND SIZES

**AMERICAN AIR COMPRESSOR Corp.**
Dell Ave. & 47th St., North Bergen, N. J.

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**Generator Voltage Regulators**
**New — Used — Sold — Exchanged — Rebuilt**

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**MODERN 1000 KW Turbo-Generator**
***In Excellent Condition***

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

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7 Panels—Modern G.E. Metal-clad 15 KV switch gear at approximately half price
1000 KW G.E. Turbo unit and condenser
500 KVA Whse. Turbo unit and condenser
Two 2000 Gal. centrifugal pumps and motors. 10,000 lbs/Hr. deaerating water heater
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600 HP 12-cylinder Hall Scott gas motor

**ROOM 4200**
**316 SOUTH LA SALLE ST.**
**CHICAGO 4, ILL.**

## SLIP RING MOTORS

3-Ph., 60 Cy.

| HP | Volts | Make | Speed |
|---|---|---|---|
| 450 | 440/220 | Whse. | 514 |
| 400 | 2300/550 | G.E. | 900 |
| 350 | 2300/440 | Whse. | 600 |
| 300 | 440/220 | Whse. | 514 |
| 300 | 440/220 | Whse. | 900 |
| 300 | 2300/440 | G.E. | 1200 |
| 200 | 440 | G.E. | 450 |
| 150 | 440/220 | Whse. (2) | 1800 |
| 150 | 2300/440 | G.E. | 1200 |
| 150 | 440/220 | G.E. | 720 |
| 100 | 440/220 | G.E. | 600 |
| 100 (2) | 440/220 | Whse. | 900 |
| 100 | 2200/550 | G.E. | 1800 |
| 80 | 440/220 | G.E. (MTC) | 900 |
| 75 | 2200/550 | G.E. | 1800 |
| 75 | 440/220 | Whse. 25 cy. | 750 |

## SYNCHRONOUS MOTORS

3-Ph., 60 Cy.

| HP | Volts | Make | Type | RPM |
|---|---|---|---|---|
| 600 | 2300/440 | G.E. | T.S. | 1200 |
| 400 | 440/220 | G.E. | ATI | 600 |
| 300 | 2200/440 | G.E. | TS | 720 |
| 300 | 440/220 | G.E. | ATI | 600 |
| 250 | 440/220 | Whse. | HR | 277 |
| 250 | 440/220 | G.E. | ATI | 600 |
| 240 | 440/220 | Whse. | G | 1800 |
| 200 | 440/220 | G.E. | TS | 720 |
| 200 | 4150/2300 | Whse | G | 1800 |
| 130 | 440/220 | G.E. | ATI | 900 |
| 110 | 440/220 | G.E. | TS | 257 |
| 100 | 440/220 | Whse. | G | 1800 |
| 75 | 2200/440 | Whse. | GE | 900 |

## GENERATOR SETS

1—62½ kva. 1200 rpm, 220 volt, Whse., geared to 7400 rpm, Whse., non-cond. steam turbine, 150 lbs. pr
3—unused 25 kva., 120/208 v., 3 ph., 1200 rpm, generator dir. conn. to Waukesha 6 cyl. gas engine

## AIR COMPRESSOR UNIT

1—13" and 8" by 10" Worthington FEATHER-VALVE, 285 rpm. 110 lbs. gs. motor-driven.

## CIRCUIT BREAKERS

3—2000 amp., GE E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse, 3 pole, 600 v., air

## SQUIRREL CAGE MOTORS

| HP | Volts | Make | Type | Speed |
|---|---|---|---|---|
| 500 | 440/220 | G.E. | IK | 900 |
| 400 | 550 | G.E. | IK | 720 |
| 300 | 2200/550 | Whse. | CS | 1800 |
| 250 | 2200/440 | L. Allis | OGS | 1200 |
| 200 | 440 | G.E. | IK | 514 |
| 200 | 440/220 | Whse | CS | 1200 |
| 200 | 440/220 | G.E. | KT | 1800 |
| 200 | 2200/440 | G.E. | KP | 720 |
| 200 | 2300/550 | Cr. Wh. | SC | 900 |
| 200 | 2200/440 | G.E. | KT | 1200 |
| 200 | 440/220 | G.E. | IK | 450 |
| 150 | 440/220 | G.E. | IK | 450 |
| 100 | 2200/550 | Whse. | CS | 900 |
| 150 | 440/220 | G.E. | KT | 720 |
| 150 | 440/220 | Howell | B. Hrs. | 1800 |
| 150 vert. | 440/220 | G.E. | KTP | 1200 |
| 150 | 440/220 | G.E. | IK | 514 |
| 125 | 440/220(2) | G.E. | IK | 514 |
| 125 vert. | 440/220 | G.E. | KTP | 1200 |
| 100 | 550 | Cr. Wh. | CJ | 900 |
| 100 | 2200/440 | G.E. | K | 1200 |
| 60 | 440/220 (new) | L. Allis | OGA | 1800 |

## A. C. GENERATORS

1—500 kva., 1200 rpm, 2300/440 v., G.E.
1—540 kva., 600 rpm., 440/220 v., G.E.
1—250 kva., 720 rpm., 2300/440v., G.E.
1—250 kva., 600 rpm., 2200/440 v., G.E.
1—275 kva., 600 rpm., 220/440 v., G.E.
210 kva. 1800 rpm. 440 220 volt. Westinghouse
140 kva. 100 rpm. 440/220 volt, Westinghouse
1—112 kva., 900 rpm., 440/220 v., G.E.
2—75 kva., 1800 rpm., 440/220 v., Whse.

## D. C. MOTORS

| HP | Volts | Make | Type | Speed |
|---|---|---|---|---|
| 250 | 230 (2) | G.E. | CD | 1150 |
| 240 | 230 (2 new) | Cr. Wh. | CMC | 1800 |
| 200 | 230 | Cr. Wh. | CMC | 890 |
| 150 | 230 (new) | Cr. Wh. | TEFC | 900 |
| 100 | 230 | Cr. Wh. | CMC | 625 |
| 100 | 230 | G.E. | CD | 1750 |
| 75 | 230 | G.E. | CD | 1150 |
| 75 | 230 | Whse. | SK | 850 |

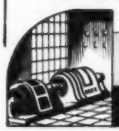
## MOTOR GENERATOR SETS

1—250 kw, 1200 rpm, 250 v., 3 wire, conn. to 500 hp 1200 rpm, 2300/440v., G.E. syn.
1—187 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp 1200 rpm, 440/220 v., squirrel cage
1—150 kw, 900 rpm, 240 v., Cr. Wh., conn. to 225 hp 900 rpm, 2200/550 v., squirrel cage
1—125 kw 1200 rpm, 250-120 v., G.E., conn. to 175 hp, 1200 rpm 4000/2300/440 v. synchronous
1—75 kw., 125 v., 1246 rpm., G.E. conn. to 120 hp., 2200/440 v. s-n motor
1—50 kw., 250 1200 rpm., G.E. conn. to 75 hp 440/220 v., 40 cy., G.E. syn. motor

## TRANSFORMERS

60 Cy.

3—500 kva, Al. Chal, 2400-480 v.
1—440 kva., G.E. 2400-230/115
3—250 kva, Whse. 2400—240/480 volts
3—200 kva, G.E., 2400—240/480 volts
3—200 kva, Moloney, 4150/7200Y—120/240 volts
2—150 kva., G.E., 13800/69y0 - 10/220 v.
1—150 kva., Whse. 8K, 13200-125/215 v., 3 ph
3—150 kva., G. E., 2300—230/460 volts
3—100 kva. G. E., 13800—230/115 v. NEW
6—100 kva. G.E. 4160/2300-230/115 NEW.
3—100 kva. G.E. 440-415/230 v. dry, 1 ph., new
4—100 kva, G.E., 440/220—220/110 v.
2—75 kva. G.E. 2300-440/120 v.
3—75 kva. G.E. H-F, 2300-230/460



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1 200 KW Ames Vertical Steam Engine-Generator
1 525 CFM Ingersoll-Rand Air Compressor
1 425 CMF Ingersoll-Rand Steam Driven Compressor
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*R. D. Zumwalt*

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(Signed) GEORGIANA ERWIN,
*Clerk-Treasurer.*

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1 Broderick Locomotive Type Boiler, 125 h.p.
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**COMPRESSORS — MOTOR DRIVEN**

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**MOTOR GENERATOR SETS**

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# ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues


Aerotec Corp. *
Air Preheater Corp. 213
Air Express Div.
Railway Express Agency 152
Allen-Sherman-Hoff Co. 117
Allis-Chalmers Mfg. Co. 12-13, 53, 63, 149, 185
Allpax Co. 170
American Air Filter Co., Inc. *
American Blower Co. 236
American Brass Co. 127
American Chimney Corp. 274
American District Steam Co. *
American Engineering Co. 222
American Locomotive Co. 176
American Pulverizer Co. 256
Ames Iron Works 264
Anchor Packing Co. 189
Arkansas Fuel Oil Co. *
Armstrong Cork Co. 161
Armstrong Machine Works 131
Associated Research, Inc. 214
Atlas Valve Co. *
Aurora Pump Co. *

Babbitt Steam Specialty Co. 192
Babcock & Wilcox Co. 4-5
Badger Mfg. Co. 268
Bailey Meter Co. 10-11
Baldwin-Hill Co. *
Baltimore & Ohio Railroad 229
Bartlett & Snow Co., C. O. 251
Beaumont Birch Co. 206
Bell & Gossett Co. *
Belmont Packing Co. *
Bernitz Furnace Appliance Co. *
Betz Co., W. H. & L. D. 123
Biddle & Co., James G. 179
Birch Mfg. Co. 274
Bird-Archer Co. *
Black, Sivalls & Bryson, Inc. 163
Blackburn-Smith Mfg. Co. 266
Blaw-Knox Co. 243
Boiler Tube of America 264
Bridgeport Brass Co. 267
Brown Instrument Co. 220
Buell Engineering Co. 180
Buffalo Forge Co. 14-15
Buffalo Pumps, Inc. 241
Bussmann Mfg. Co. 44-45
Byers Co., A. M. 72

Canton Stoker Corp. 252
Carborundum Co. *
Cash Co., A. W. 61
Catawissa Valve & Fittings Co. 194
Chapman Valve Mfg. Co. 151
Chesterton Co., A. W. 162
Chicago Metal Hose Corp. *
Chicago Pneumatic Tool Co. 242
Cities Service Oil Co. *
Clarage Fan Co. *
Clark Bros. Co., Inc. *
Clark Mfg. Co. 186
Cleaver-Brooks Co. *
Cochrane Corp. 259
Combustion Engrg.-Superheater, Inc. 18-19
Condenser Service & Engrg. Co. 197, 266
Coppus Engineering Co. 159
Crane Co. 139

Dampney Co. of America 172
Darling Valve & Mfg. Co. 254
Dart Mfg. Co., E. M. 156
Davis Regulator Co. 196
DeLaval Separator Co. 57
DeLaval Steam Turbine Co. 68, 198
Detroit Stoker Co. *
Diamond Power Specialty Co. 8-9
Dings Magnetic Separator Co. *
Dowell, Inc. 147
Dravo Corp. 143, 192
Drew Co., Inc., E. F. 217
Dynamatic Corp.
Sub. of Eaton Mfg. Co.) 203

Eagle-Picher Co. 46-47
Eaton Mfg. Co.
(Dynamatic Div.) 203
Economy Pumps, Inc. *
Edward Valves, Inc. 32-33
Eisler Engineering Co., Inc. 210
Electric Machinery Mfg. Co. 225
Electric Storage Battery Co. *
Elgin Softener Corp. 211
Elliott Co. 6-7
Engineer Co. 234
Erie City Iron Works 215
Ernst Water Column & Gauge Co. 274

Fairfield Engineering Co. 232
Fairmont Coal Bureau 199
Felt Products Mfg. Co. 272
Fisher Governor Co. 231
Flexo Supply Co., Inc. 266
Fluor Corp., Ltd. *
Foster Engineering Co. 183
Foster Wheeler Corp. 42-43
Foxboro Co. *
Flick Co. *
Fuller Co. *

Garlock Packing Co. *
General Coal Co. *
General Electric Co.
(Apparatus Dept.) 35-36, 198, 202, 208
Gifford-Wood Co. 239
Golden-Anderson Valve Spec. Co. 235
Goodyear Tire & Rubber Co. *
Goulds Pumps, Inc. 249
Graver Tank & Mfg. Co. 269
Graver Water Conditioning Co. 269
Grinnell Co. Third Cover
Griscom-Russell Co. 257
Gulf Oil Corp. 157
Gulf Refining Co. 157
Gunite Concrete & Construction Co. 210

Hagan Corp. 54-55
Hall Laboratories 28-29
Harbison-Walker Refractories Co. *
Hays Corp. *
Heacon, Inc. 66-67
Hendrick Mfg. Co. 170
Hensley Co. 198
Hewitt Rubber Div.
Hewitt Robins, Inc. 195
Heyl & Patterson, Inc. *

Hill Pump Valve Co. 274
Homestead Valve & Mfg. Co. 261

Illinois Water Treatment Co. *
Infilco, Inc. *
Ingersoll-Rand Co. 155
International Nickel Co. 240

Jefferson Union Co. 206
Jenkins Bros. 134-135
Jerguson Gage & Valve Co. *
Johns-Manville 129
Jones Foundry & Machine Co., A. W. *
Joy Mfg. Co. 181

Keasbey & Mattison Co. 226
Kellogg Co., M. W. 237
Kennedy Valve Mfg. Co. 160
Kennedy-Van Saun Mfg. & Engrg. Corp. 22-23
Kewanee Boiler Corp. 206
Kinney Mfg. Co. *
Klingerit, Inc. 266
Klipfel Mfg. Co. *
Koppers Co. (Coupling Dept.) 175
Koppers Co. (Elex Precipitator Dept.) 262

Ladish Co. *
Lapp Insulator Co., Inc. *
Lee Engineering Co. 197
Leeds & Northrup Co. Second Cover
Link-Belt Co. 3
Liquidometer Corp. 270
Lockett & Co., Ltd., A. M. 210
Lummus Co. *
Lumnite Div.
Universal Atlas Cement Co. *
Lunkenheimer Co. 16-17

Manheim Mfg. & Belting Co. *
Manning, Maxwell & Moore, Inc. 263
Manzel, Inc. *
Marley Co. *
Marsh Corp., James P. *
Mason-Neilan Regulator Co. 164
Maxim Silencer Co. *
McAlear Mfg. Co. 174
McGraw-Hill Book Co. 270, 272
Mercoid Co. *
Midwest Piping & Supply Co. 209
Milton Roy Co. 270
Minneapolis Honeywell Regulator Co.,
Belfield Valve Div. 245
Mitchell & Co., W. K. *
Modine Mfg. Co. 246
Monsanto Chemical Co. *
Murray Iron Works 200

National Airoil Burner Co., Inc. *
National Aluminate Corp. 133, 192
National Electric Coil Co. 218
National Tube Co. 258
National Valve & Mfg. Co. 56
Niagara Blower Co. *
Nicholson Co., W. H. 188
Nordberg Mfg. Co. 227

Northern Equipment Co. ..... 137
Norton Co. ..... 250
Nugent & Co., Wm. W. ..... 178

Oakite Products, Inc. ..... 176
Ohio Coal Association ..... 165
Ohio Injector Co. ..... 171
Owens-Illinois Glass Co. (Kaylo Div.) ..... 253

Peerless Pump Div., Food Machy. & Chemical Corp. ..... *
Pennsylvania Crusher Co. ..... 223
Penn Flexible Metallic Tubing Co. ..... *
Permutit Co. ..... 247
Philadelphia Gear Works ..... 167
Pioneer Service & Engrg. Co. ..... 182
Pipe Fabrication Institute ..... *
Pittsburgh Piping & Equipment Co. ..... 230
Pittsburgh Steel Co. ..... 205
Pittston Co. ..... 207
Plibrico Jointless Firebrick Co. ..... 275
Portland Shingle Co. (Borgana) ..... *
Powell Co., Wm. ..... 60-61
Powers Regulator Co. ..... 20-21
Prat-Daniel Corp. ..... 48-49
Preferred Utilities Mfg. Co. ..... 238
Pritchard & Co., J. F. ..... 255

Quaker Rubber Co. ..... *

Raybestos-Manhattan, Inc. Packing Div. ..... 65
Reliance Gauge Column Co. ..... 62
Republic Flow Meters Co. ..... 50-51
Republic Rubber Div. Lee Tire & Rubber Co. ..... 248
Republic Steel Corp. ..... 58-59
Research Corp. ..... 260
Revere Copper & Brass, Inc. ..... 141
Richardson Scale Co. ..... 212
Ric-Wil Co. ..... *
Riley Stoker Corp. ..... 106-107
Robins Conveyors Div. Hewitt Robins, Inc. ..... 195
Roto Div. of Elliott Co. ..... 184

Santa Fe Tank & Tower Co. ..... 214
Sarco Co. ..... 169
Schutte & Koerting Co. ..... 125
Shaw Co., B. F. ..... 145
Sier-Bath Gear & Pump Co. ..... 202
Simplex Valve & Meter Co. ..... *
Sinclair Refining Co. ..... *
Skinner Engine Co. ..... 166
Smith Corp., A. O. ..... 201
Smith Refractories, Sanford S. ..... *
Socony-Vacuum Oil Co. ..... *
Springfield Boiler Co. ..... 37
Standard Oil Co. of Indiana ..... 30-31
Standard Stoker Co., Inc. ..... *
Steel & Tubes Div. ..... 58-59
Stephens-Adamson Mfg. Co. ..... 38
Stickle Steam Specialty Co. ..... 150
Stock Engineering Co. ..... 158, 182
Stone & Webster Engineering Corp. ..... *
Strong, Carlisle & Hammond Co. ..... 233
Struthers Wells Corp. ..... *
Sturtevant Div. Westinghouse Electric Corp. ..... *
Sun Oil Co. ..... 121
Superior Combustion Industries ..... 177
Swartwout Co. ..... 300

Taylor Forge & Pipe Works ..... 273
Taylor Instrument Co's ..... 244
Terry Steam Turbine Co. ..... 228
Texas Co. ..... Back Cover
Thermix Corp. ..... 18-19, 66-67
Tidewater Associated Oil Co. ..... 187
Timken Roller Bearing Co. ..... 173
Todd Shipyards Corp. Combustion Equipment Div. ..... *
Topflight Tape Co. ..... 274
Troy Engine & Machine Co. ..... 214
Tube-Turns, Inc. ..... 221

Union Asbestos & Rubber Co. ..... 271
Union Iron Works ..... *
U. S. Steel Corp. ..... 258

Viking Pump Co. ..... 188
Vogt Machine Co., Henry ..... 224
Vulcan Soot Blower Corp. ..... 24-25

Wallace & Tiernan Products, Inc. ..... *
Walworth Co. ..... 265
Warren Steam Pump Co. ..... 216
Watson-Stillman Co. ..... 190
Western Chemical Co. ..... 154
Westinghouse Electric Corp. ..... 70-71
Weston Electrical Instrument Co. ..... 168
Wheeler Mfg. Co., C. H. ..... *
Where to Buy ..... 274
Whiton Machine Co. ..... 204
Wickes Boiler Co. ..... 191
Wiedeke Co., Gustav ..... *
Williams Gauge Co. ..... *
Wing Mfg. Co., L. J. ..... *
Worthington Pump & Machy. Corp. ..... 34, 39-40-41, 52, 153, 193
Wright Chemical Co. ..... *

Yarnall-Waring Co. ..... 26-27, 119
Youngstown Sheet & Tube Co. ..... 219

Zallea Bros. ..... *

**Professional Services** ..... 274


## SEARCHLIGHT SECTION

**(Classified Advertising)**


EMPLOYMENT
Positions Vacant ..... 276
Selling Opportunities Offered ..... 276
Positions Wanted ..... 276
Selling Opportunities Wanted ..... 276
Employment Agencies ..... 276
Employment Services ..... 276

NOTICES
Legal ..... 276

EQUIPMENT (Used or Surplus New)
For Sale ..... 277-297

WANTED
Equipment ..... 296

ADVERTISERS INDEX
Albion, The Town of ..... 296
Aljohn Diesel Co., Inc. ..... 294
Allied Equipment Co. ..... 292
American Air Compressor Co. ..... 294
Arrow Transformer Co., Inc. ..... 291
Atlantic Transformer Co. ..... 288
Bauer, L. W. ..... 296
Beeson Engineering Co. ..... 288
Belyea Co., Inc. ..... 280
Boston Metals Co., The ..... 287
Boswick Electric Co., The ..... 291
Brearley, Harry ..... 289
Brew, Woltman & Co. ..... 289
Chicago Electric Co. ..... 288
Consolidated Products Co., Inc. ..... 286
Denny & Clark ..... 286
Diesel Motors Corp. ..... 291
Dougherty, J. A. ..... 292
Douglass Co., Stephen A. ..... 297
Duquesne Electric & Mfg. Co. ..... 286
East Coast Valve & Fitting Co., Inc. ..... 296
Ebasco Services, Inc. ..... 297
Electric Apparatus Repair Co. ..... 297
Electric Equipment Co. ..... 296
Electric Generator & Motor Co. ..... 287
Electric Service Co., Inc. ..... 296
Ellis Co., A. Lee ..... 289
Empire Electric Co., Inc. ..... 285
Erie Electric Co., Inc. ..... 290
Fish, Charles V. ..... 288
Fletcher Sales Co. ..... 295
Friedrich, Inc., Ed. ..... 296
Glow Electric Co. ..... 278
H & P Machinery Co. ..... 291
Hall & Co., Stephen ..... 295
Heat & Power Co., Inc. ..... 295
Hemphill & Co., J. L. ..... 283
Hercules Elect. Machy. & Equip. Co. ..... 291
International Milling Co. ..... 297
International Power Machy. Co. ..... 293
Johnson & Associates, Howard B. ..... 295
Johnson, B. W. ..... 297
Kaelber Co., Frederick W. ..... 276
Kearney & Trecker Corp. ..... 297
Kirk Co., Wallace ..... 289
Land Inc., L. J. ..... 281
Landsdale Municipal Power Plant ..... 292
Lebanon, City of ..... 297
Mississippi Valley Equipment Co. ..... 295
Montgomery Engineering Co. ..... 297
Moulton, Wm. C. ..... 294
Neu Corp., Hugo ..... 293
Newman & Co., Inc. ..... 294
Northern Metal Co. ..... 292
Penn. Machinery Co. ..... 295
Pennsylvania Power & Light Co. ..... 276
Pierce Cable Co. ..... 296
Porter Electric Co. ..... 294
Powerite Corp ..... 295
Power Plant Equip. Co., Inc. ..... 297
Purity Bakeries ..... 297
Rearick, Charles B. ..... 292, 295
Schoonmaker Co., Inc., A. G. ..... 277
Sherman Co., H. P. ..... 297
Stanhope, L. M. ..... 297
Stanolind Pipe Line Co. ..... 294
Stephenson & Co., Dell ..... 294
Stewart, Paul ..... 294
Strickler & Associates, Dean G. ..... 292
Superior Equipment Co. ..... 288
Tarshis & Sons, L. S. ..... 297
Tex-O-Kan Ebur Mills Co. ..... 296
Thompson Co., Inc., J. Parker ..... 286
Tomsett Associates ..... 276
Universal Wire & Cable Co. ..... 297
Utilities Machinery Corp. ..... 282
Wagner Co., Arthur ..... 279
Weaver Charles ..... 290
Weinstein Co. ..... 296
Wente Electric Co., The ..... 294
Western Regulator Exchange ..... 294
Winston Machinery Co., Inc. ..... 297

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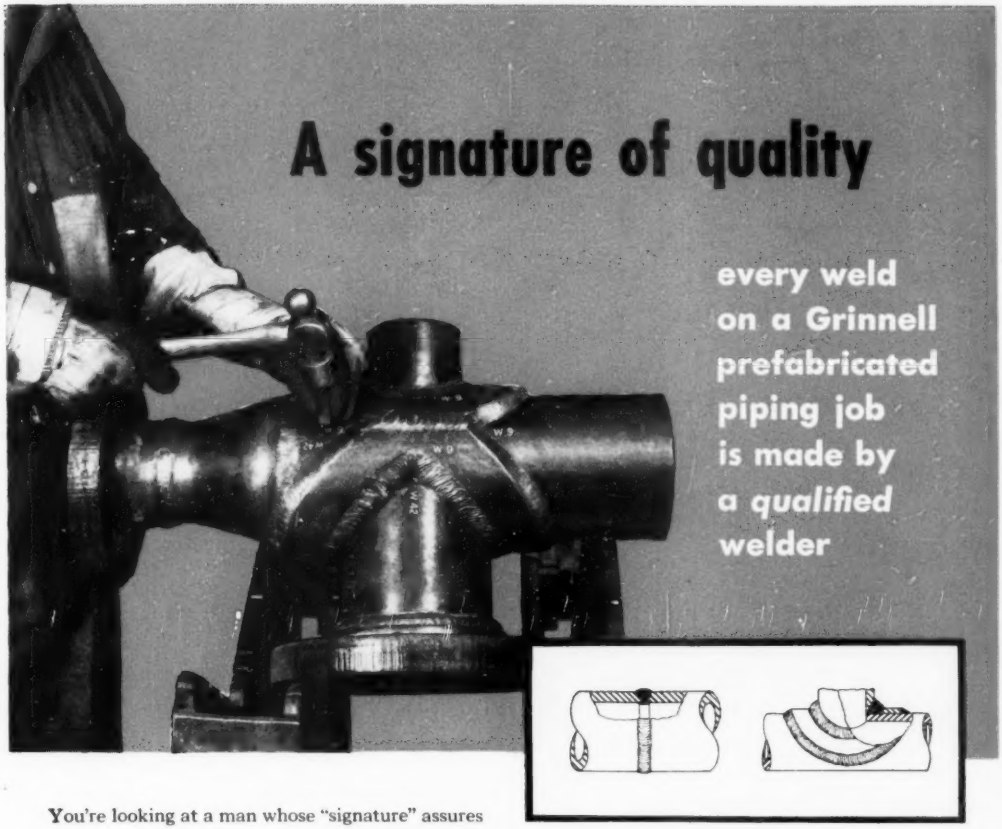

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